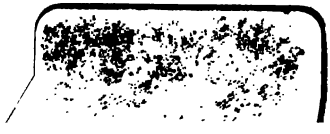


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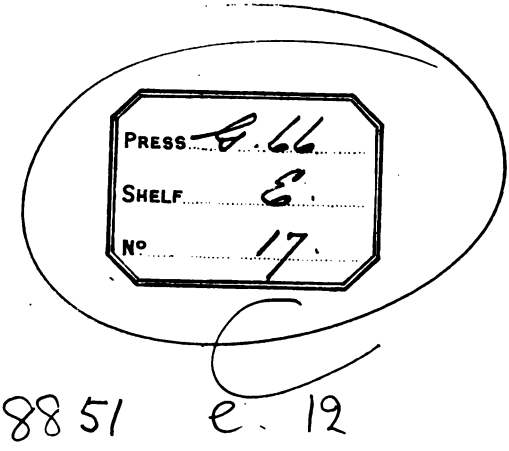


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OBSERVATIONS

ON THE

DETRITAL TIN-ORE

OF

CORNWALL.

By WILLIAM JORY HENWOOD, F.R.S., F.G.S.,

SOMETIME HER MAJESTY'S ASSAY-MASTER OF TIN IN THE DUCHY OF CORNWALL.

Reprinted from No. XV of the Journal of the Royal Institution of Cornwall, 1873.

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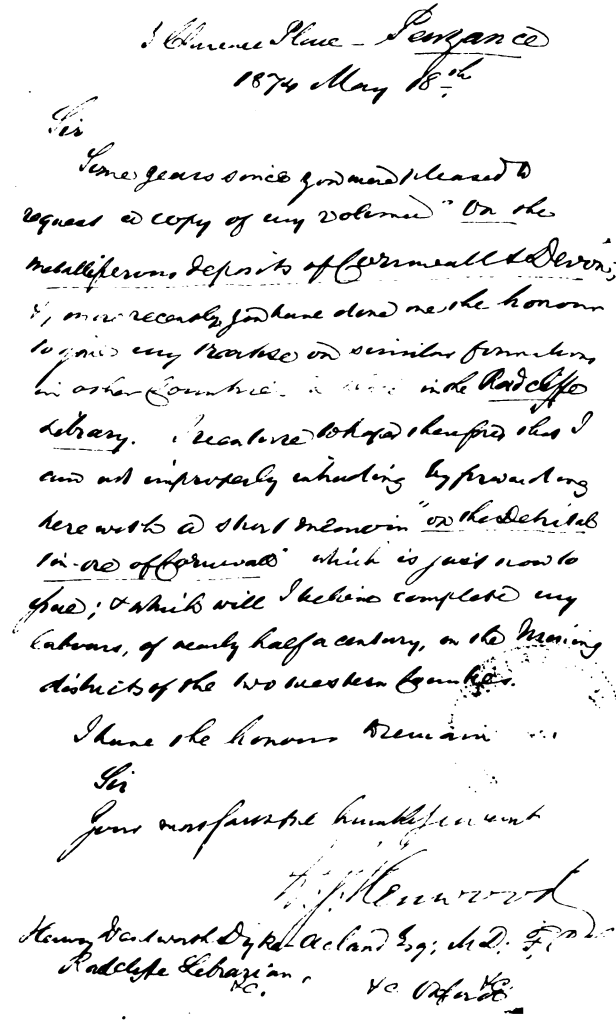

1 Clarence Place - Penzance
1874 May 18th

Sir

Some years since you were pleased to request a copy of my volume "On the metalliferous deposits of Cornwall & Devon", & more recently you have done me the honour to quote my remarks on similar formations in other countries in the Radcliffe Library. I am sorry to find therefore that I am not in a position to forward you here with a short memoir "on the detailed structure of Cornwall" which is just now to hand; & which will I believe complete my labours, of nearly half a century, on the mining districts of the two western Counties.

I have the honour to remain &c

Sir

Your most faithful humble servant

R. Hunt

Henry Wentworth Dyke Acland Esq; M.D. F.R.S.
Radcliffe Librarian, Oxford

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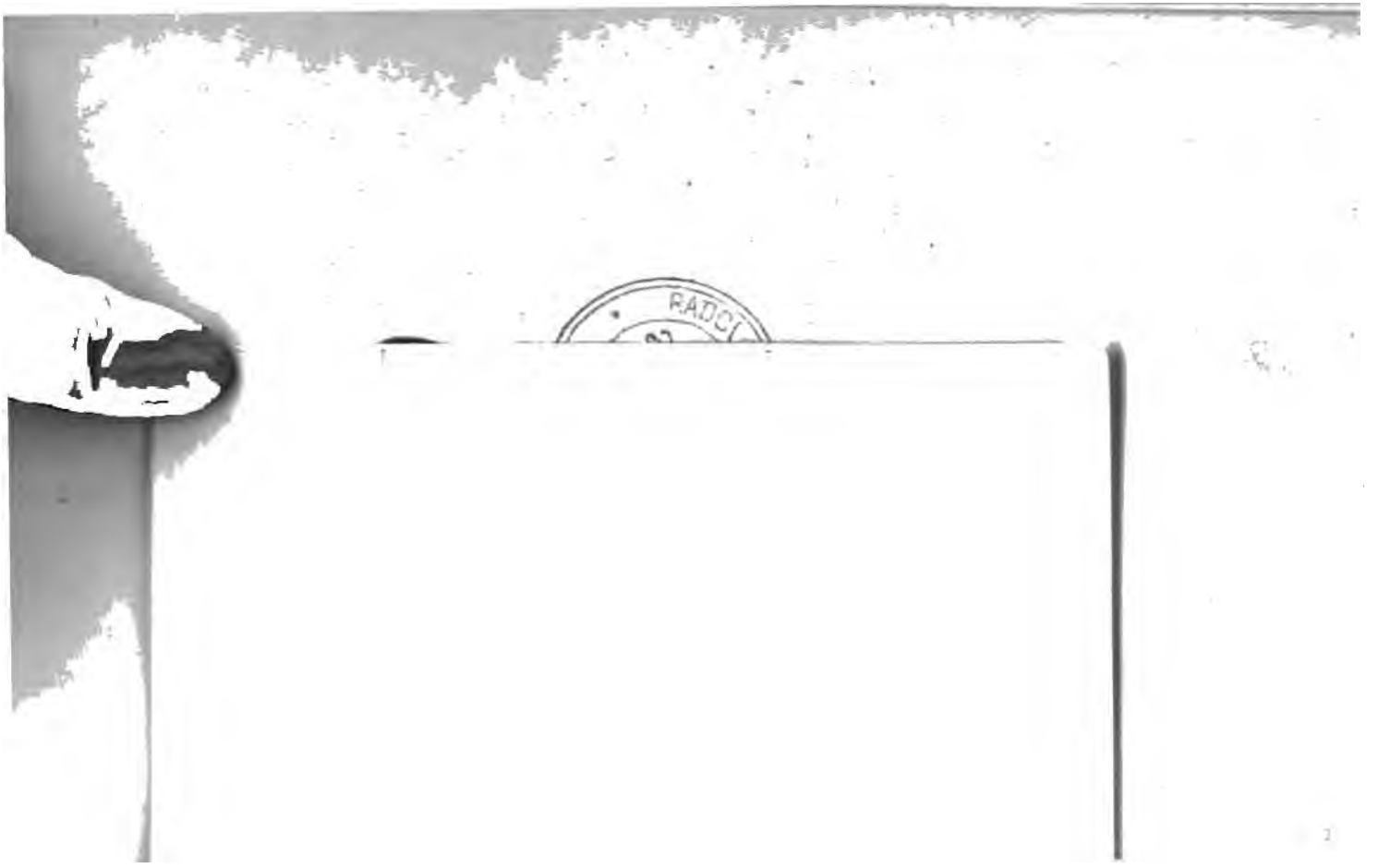
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OBSERVATIONS

ON THE

DETRITAL TIN-ORE OF CORNWALL.

Reprinted from Number XV of the Journal of the Royal Institution of Cornwall, 1878.

AS the detrital deposits of tin-ore in Cornwall and Devon have been wrought from remote antiquity, they are nearly—though not yet quite—exhausted. The most important* have often, and other of them† have sometimes, been described; on some few,

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* The rich and extensive deposit at Carnon has been described by Maton, *Observations on the Western Counties*, ii, p. 173. Rashleigh, *British Minerals*, i, p. 5. Berger, *Geol: Trans:* i, p. 162. De Luc, *Geological Travels*, iii, p. 325. Smith, *Ibid*, iv, p. 409. Hitchins and Drew, *History of Cornwall*, ii. p. 264. Sedgwick, *Annals of Philosophy*, ix, p. 249. Dufrénoy, De Beaumont, Coste, et Perdonnet, *Voyage Métallurgique en Angleterre*, ii, p. 261. Henwood, *Cornwall Geol: Trans*: iv, p. 57, v, p. 91.* The large and productive formation at Pentuan has been illustrated by Bonnard, *Journal des Mines*, xiv, p. 450. De Luc, *Geological Travels*, iii, p. 338. Smith, *Geol: Trans*: iv, p. 404. Hitchins and Drew, *History of Cornwall*, ii, p. 62. Héron de Villefosse, *Richesse Minérale*, ii, p. 354, *Pl.* xxi, *Fig.* 7. Sedgwick, *Annals of Philosophy*, ix, p. 247. Dufrénoy, De Beaumont, Coste, et Perdonnet, *Voyage Métallurgique en Angleterre*, ii, p. 258. Colenso, *Cornwall Geol: Trans*: iv, p. 29, *Pl.* i. Winn, *Reports of the Royal Institution of Cornwall*, xxi, (1839), p. 45; xxii, (1840), p. 38. Combe's, *L'Exploitation des Mines*, i, p. 352, *Pl.* xiii, *Fig.* 3. Stocker, *Transactions of the Penzance Natural History Society*, ii, p. 88. Von Cotta, *Ore-Deposits*, p. 421. Flower, *Annals and Magazine of Natural History*, 4th Series, ix, p. 440.

† Smaller accumulations of similar character, worked at Dowran, Pillianeth, Pemedar, Leswhidden, Bostraze, Drift, Numphra, Kerris, Chyvenhall, Clija, and Marazion-marsh, in the western—at Porthleaven, Loepool, Porkellis, Porcreath, Porth Towan, and Perran-porth, in the central;—at Tregony, Pensagillis, Hallibesack, Frog-moor, Swan-pool (Ladock), Treloy, Goss-moor, Gaverigan, Poth (Porth), Par, Sandrycock, Tregurthy-moor, Merry-meeting, Mullinis, Grove, Levrean, Water-gate, Pendelow, Broadwater, and Bodgara-moors, in the eastern part of Cornwall; and at Lydford, Walkhampton, Sheepstor, Manadon, Chagford, Kingsteignton, and Teigngrace, in Devonshire; have been described—by Borlase, *Natural History*, (second edition), p. 162. Pryce, *Mineralogia Cornubiensis*, p. 68. Jars,

operations are still in progress, and to these, most of the following notices relate.

Between the Land's-End and Saint Ives the granite and the slate, in contact with it on the north and north-east, are traversed by metalliferous-veins *(lodes)*; but their numbers, directions,* and mineral characters differ in various parts of the district. Towards the south they are poorer and less numerous than in any other portion of the neighbourhood; yet one of the few mines† wrought here has yielded some amount of *wood*-tin-ore. The central region is more productive; and, in one spot, at least, tin-ore not only forms numberless thin veins, but is so generally disseminated, that—so to speak—it is an ingredient of the rock.‡ Near the northern and north-eastern boundaries of the several series, however, many rich *lodes* have been, and—indeed—still are, largely and profitably worked. In some instances also *off-shoots* (if they may be so designated) of great, but of yet unascertained, length,

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Voyages Métallurgiques, iii, p. 188. Klaproth, *Mineralogical Observations*, p. 12. Maton, *Observations on the Western Counties*, i, p. 152. Rashleigh, *British Minerals*, i, p. 5; ii, p. 24, *Pl.* xxi. *Cornwall Geol*: *Trans*: ii, p. 281. Berger, *Geol*: *Trans*: i, pp. 153, 161. De Luc, *Geological Travels*, iii, pp. 155, 211. Smith, *Geol*: *Trans*: iv, p. 409. Hawkins, (Sir C.), *Cornwall Geol: Trans*: i, p. 235. Majendie, *Ibid*, p. 237. Sedgwick, *Annals of Philosophy*, ix, p. 249. Hawkins, (John), *Cornwall Geol: Trans*: ii, p. 235. Paris, *Guide to the Mount's-Bay*, p. 197. Michell, *Manual of Mineralogy*, p. 72. Carne, *Cornwall Geol*: *Trans*: ii, pp. 293, 331; iv, (1830), pp. 47, 95, vi, p. 233. Boase, *Ibid*, iii, p. 31. Thomas, (R.), *History of Falmouth*, p. 31. Henwood, *Cornwall Geol*: *Trans*: iv, (1828-9), p. 60; v, pp. 14, 34, 42, 55, 68, 90,• 110, 129, 141; viii, p. 695; *Address to the Royal Institution of Cornwall Journal*, No. xi, p. x. De la Beche, *Report on the Geology of Cornwall, Devon, and West Somerset*, p. 401. Barratt, *Ibid*, p. 403. Allen, *History of Liskeard*, pp. 4, 27, 204. Rogers, (J. Jope), *Cornwall Geol*: *Trans*: vii, p. 352. Polwhele, *Historical Views of Devonshire*, i, p. 110. *History of Devonshire*, i, p. 158. Lysons, *Devonshire*, i, p. cclxx. Rowe, *Perambulation of Dartmoor*, p. 68, 255, 312. Von Cotta, *Ore-Deposits*, p. 421.

• Carne, *Cornwall Geol: Trans*: ii, p. 321. Henwood, *Ibid*, v, pp. 9. 250; *Table*, ciii; viii, p. 674; *Journal of the Royal Institution of Cornwall*, No. xiii, (1871), p. xvi. Moissenet, *Annales des Mines*, 6me Série, iii, p. 161.

† Klaproth, *Mineralogical Observations*, p. 21. Carne, *Cornwall Geol: Trans*: iv, p, 95. Henwood, *Ibid*, v, p. 32.

‡ Henwood, *Cornwall Geol*: *Trans*: v, p. 235; viii, p. 664; *Journal of the Royal Institution of Cornwall*, No. xiii, p. xiii.

of irregular width, and of small, yet unequal vertical range *(Carbonas)** spring from the *lodes;* and in one locality unconnected metalliferous masses of enormous dimensions are imbedded in the granite.† Throughout the whole tract tin-ore has been the principal product,‡ but here and there copper-ore has, from time to time, abounded; and several mines have afforded other metallic minerals,§ but in much smaller quantities.

From *Balleswidden,* in the south-east of Saint Just—where the rock is, more or less, sprinkled with tin-ore*—the surface declines for some distance, towards the south-west; but, as the slope is greater in the middle than at the sides, these soon converge in a narrow glen, which from Kelynack trends north-westward to the beach at Pornanvon.‖ A deposit of detrital *(Stream)* tin-ore in the southern and central parts of this ravine¶ has long since been exhausted; but at Bosworlas, on the northern margin, a narrow strip of virgin *tin-ground* has afforded employment to successive generations of the same family during great part of the present century.

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* Henwood, *Cornwall Geol: Trans*: v, p. 21; vii, p. 179; *Pl.* i; *Journal of the Royal Institution of Cornwall,* No. xiii, p. xxvi. Haughton and Scott, *Mineral Agent's Handbook,* p. 39.

† Henwood, *Cornwall Geol*: *Trans*: v, p. 24.

‡ Within the boundaries of this district the undermentioned masses of Jew's-house-tin have been obtained;—

at Pillianeath, in St. Just....weighing 5lbs.		Carne, *Cornwall Geol*: *Trans*: ii, p. 293.
,, Bossuliack, in Madron.... ,, —		Le Grice, *Ibid,* vi, p. 44.
,, Trereife, ,, ... ,, 26lbs.		,, ,, ,, 45.
,, Tremethick, ,, ... ,, 38 ,,		Whitley, (H. M.), *Journal of the Royal Institution of Cornwall,* No. xiii, p. lxxxviii; Collins, *Ibid,* p. 83.

§ Borlase, *Natural History,* p. 209. Carne, *Cornwall Geol: Trans*: ii, pp. 296-304; vi, p. 48. Boase, *Ibid,* ii, p. 384. Henwood, *Ibid,* v, pp. 12, 19; *Ibid,* viii, p. 444. Penberthy, *Ibid,* vi, p. 106.

‖ Borlase, *Natural History,* p. 76, *Pl.* xix, *Fig.* 4. Carne, *Cornwall Geol*: *Trans*: ii, p. 343; iii, p. 230. Henwood, *Ibid,* v, p. 13.

¶ The water used for washing *(Dressing)* purposes at *Balleswidden* flows down this gorge; and particles of ore which it carries off in suspension, are collected and subjected to further treatment here.

At the spot now wrought:—

(1). Vegetable mould extends from the surface....to a depth of 2 or 3 feet; which, in some parts of the glen, is succeeded by:—

(2). Granitic gravel and shingle,* sparingly mixed with subangular masses of granite and its congeners containing thin strings of various vein-stones, sometimes sprinkled with tin-ore;..... ,, ,, a few inches; this, however, is scarcely distinguishable from—

(3). The *tin-ground*, which also consists of granitic matter, subangular and rounded fragments of tin-bearing vein-stones, and pure tin-stone either more or less rounded or in angular fragments .... ,, 3 inches to 2½ feet.

The surface of the tin-ground maintains, throughout the ravine, a tolerably uniform slope seaward; the rather considerable differences in its thickness being consequent on irregularities of contour in the granite *(shelf)* beneath. This varies little in composition, but much in hardness, within short distances; moreover in the softest portions the depressions (erosions?) are deepest and most numerous, and—at the same time—the bed of tin-ore is thickest and best.†

Large blocks of coarse-grained granite‡ occur at intervals;

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* Pebbles of slate are mixed with gravel, shingle and boulders of granite in the cliff at and near Pornanvon. BORLASE, *Natural History*, p. 76. CARNE, *Cornwall Geol: Trans*: iii, p. 230. HENWOOD, *Ibid*, v, p. 13.

† At Merry-meeting near Roche the stream-tin-ore is richest and most abundant where the granite beneath it is softest. HENWOOD, *Ibid*, iv, p. 61.

‡ As the coarse texture, and open-jointed prismatic structure of the granite offer most favourable conditions to disintegrating atmospheric influences, it is scarcely surprizing that this district contains no fewer than eleven *logan-rocks;* viz., in:—

Saint Levan, three.

1 At Castle Treryn ..... The Logan-rock..... Mentioned in every Itinerary of the district;—
1 ,, near the base of the Cairn, a smaller one.. Undescribed:—
1 At Bosistow-cliff ..... Described and figured, (BLIGHT, *Land's-End*, p. 120);—

Towednack, one.

1 On Rosewall hill, ... Mentioned, (HENWOOD, *Cornwall Geol: Trans*: v, p. 18);—

but here and there they are so closely grouped as to afford mutual support. Some of them rest on the vegetable mould, others touch the gravel and shingle; usually, however, they reach—and a few intrude on—the *tin-ground*,* but in no instance have they passed, quite throughout it, to the granite beneath.

Near Bejowans in Sancred the bed of a confluent with the little vale which extends from Tregonebris to the coast at Lamorna, presents the following section:—

(1). Granitic sand and gravel, mixed with small angular and subangular masses of granite ..... 6 to 12 feet;
(2). Peat; in which nuts and branches and roots of hazel are imbedded here and there..... 2 „ 8 „
(3). Granitic sand, gravel, and pebbles, sparingly interspersed with large boulders of granite ..... a few inches; this—except that it is generally unproductive—differs but little from—

Zennor, seven.

1 Near the summit of Carn Galver ..... Discovered and sketched by Mr. Joseph Blight.
1 N. of the Church ..... Described (Blight, *Land's-End*, p. 220.
1 Near Tregarthen-cottage *(The Eagle's-nest)* .... Undescribed.
1 „ „ „ „ „ S.W. .... Undescribed. Discovered by Captain Pooley, of *Trelyon*.
3 Half a mile S. of Tregarthen-cottage and a furlong E. of Zennor Cromlech ..... } Photographed by Ashton of Saint Ives .....

To a casual observer the three small *logan-rocks* on Tregarthen-hill differ but little from the other groups of granite scattered over the moist, furze-clad, surface; but on inspection a flattish rock, of small extent, is found to support—at two or three feet above the general level,—two contiguous rocks, of like mineral character, and on one of the two rests a third, of the same kind. All may be easily moved; and whenever one of them is set in motion both the others move with it, though to a smaller extent; but by application of a different force to each it may take a peculiar movement of its own.

In 1769 *logan-rocks* existed at Bosworlas in Saint Just and at Karn-lehau in Towednack, (Borlase, *Antiquities of Cornwall*, Second edition, p. 180, *Pl.* xi, *Fig.* 3); but in 1812 the former had ceased to be moveable, (Buller, *Statistical Account of Saint Just*, p. 87, and of the latter no intelligence is now to be obtained.

* Enormously large masses of quartz rest on the *tin-ground* at *Merry-meeting*. Henwood, *Cornwall Geol*: *Trans*: iv, p. 61.

(4). The *tin-ground*, which consists generally of rounded masses of felspathic granite and of tin-ore; the latter being, in great measure, *(wood-tin)* of divergingly-fibrous structure; with ore of this kind both the pyramids and the prisms of crystals of quartz, are now and then invested.* Fragments of different vein-stones, and not unfrequently crystals of quartz, are imbedded in the other ingredients ..... 2 to 9 feet.

The granite *(shelf)* beneath abounds in felspar but contains little quartz or mica. Within short distances, however, it varies in hardness, and everywhere its surface is uneven; in the softest parts the depressions are deepest, and here the ore is both richest and most plentiful.

Between Towednack-church and Amellibrea operations in the lower part of Cold-harbour-moor disclose:—

(1). Peat ..... for a depth of 2½ feet;
(2). Disintegrated, subangular, granitic matter, (gravel); unequally mixed with blue clay to different depths in various parts of the vale; but generally unproductive ..... ,, ,, 3 ,,

Beneath the clay a brownish-buff hue prevails, and small quantities of tin-ore are scattered through the gravel; but lower and more productive portions of the deposit assume a reddish brown tint; and, in these, angular and, more or less, rounded masses of tin-bearing vein-stones are numerous ..... ,, ,, 6½ ,,

The granite *(shelf)* underneath presents an undulating surface of unequal hardness; from the deeper depressions in the softer parts of which moderate quantities of detrital tin-ore have been obtained.

At Tregilsoe,† on the confines of Ludgvan and Saint Hilary, a section of the short and shallow vale which terminates in Marazion-marsh, presents—

(1). Peat;—of which the surface—maintaining a tolerable parallelism to that of the *tin-ground*—declines irregularly, but the thickness is, pretty uniformly, about .... 6 feet;

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* Klaproth, *Mineralogical Observations on Cornwall*, p. 20. Rashleigh, *British Minerals*, i, p. 48, *Pl.* xxxii, *Fig.* 1. Carne, *Cornwall Geol: Trans:* iv, p. 100.

"A remarkable mamillated variety [of *wood-tin*] has occurred very lately, *in situ*, at Sancreed, it is in the form of thick concretions capping crystals of quartz."

GREG and LETTSOM, *Manual of Mineralogy*, (1858), p. 358.

† Named Tregilliow in the *Ordnance Geological Map of Cornwall*, Sheet xxxiii.

(2). The *tin-ground*, throughout its entire width, is divided—obliquely both to its surface and to the *(shelf)* rock it rests on—by a thin seam of clay impervious to water; and on opposite sides of this it is of remarkably different appearance.

The upper part consists of angular and subangular masses of slate, of quartz, and of various *(Shodes)* vein-stones, and of smaller bodies and granules of crystalline tin-ore bearing traces of fracture or of abrasion, all imbedded in bluish clay.

In the lower portion pebbles of slate still prevail, and nodules of felspathic porphyry *(Elvan)* are not uncommon; but quartz occurs less frequently and in smaller masses; the tin-ore rarely appears unmixed, but—contrariwise—is diffused through matrices natural to it in the slate-series. The interstices are filled with tough clay of reddish-brown hue. The deepest are not always the richest parts of the deposit..... 9 feet.

The works are within a mile and a half S.E. of the granite, yet they afford no trace of granitic matter.

The tender and fissile *(Shelf)* slate beneath—often little other than laminated-clay—rapidly softens on exposure; and the perceptible disintegration and consequent increase of volume, give—so to speak—a yeasty appearance to the semi-fluid mud.

Small quantities of *Stream-tin-ore* have been obtained also at Penrose in Sennen, Tregadgwith in Saint Burian, and in some other glens which open to the sea between the Land's-end and Penzance; but—even at the high prices which have lately prevailed—the proceeds have not sufficed to pay the workmen. Near the confluence of the streams from Cold-harbour-moor* and Tregilsoe,† at the head of Marazion marsh,‡ an inconsiderable deposit of this

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* *Ante*, p. 196.

† *Ibid*, p. 196.

‡ "The open sea (as I have seen in the Mount's Bay) throws in [tin-ore] to us in a pulverized state." [This] "comes probably from some lodes, "which, lying bare to the sea, have their upper parts fretted off, and by "storms thrown in among the sands." BORLASE, *Natural History*, p. 164.

"The sand of the eastern or Marazion *green* affords tin-ore sufficient "to pay in some measure for its *streaming*, which process on a small scale "is here in actual operation."

BOASE, *Cornwall Geol: Trans:* iii, p. 178.

"A bed of *stream tin-ore* of very inferior produce, some 20 or 30 feet "above the sea-level near Newtown, on Marazion green, has for many years "afforded employment to a few persons; and in the vale between *Wheal* "*Darlington* and the *Marazion Mines* a thin and poor bed of *tin-ground* rests "on the *shelf* at about the sea-level; on this reposes a bed of vegetable "matter containing the trunks and branches of oak, willow, hazel, and per-"haps other trees, as well as nuts in abundance; this is again covered, to "the level of the slimy soil which bears the present vegetation, by sea-sand "mixed with shells." HENWOOD, *Ibid*, v, p. 34.

CARNE, *Ibid* vi, p, 233.

kind, was wrought,—by aid of a small high-pressure pumping engine—for several years.

The comparatively small body of granite* extending from Godolphin-hill to the sea,—the slate† bounding it landward,—and the *elvans*‡ traversing both granite and slate—are all intersected by numerous *lodes* which take an average direction of about 16° N. of E.–S. of W.§ Of these a few have afforded the ores of copper; but all other have been, and still are rich in tin-ore, of which, indeed, this district is one of the most productive in Cornwall.‖

The southern part of the tract is drained by the short deep glen which reaches the coast at Porthleaven; but it bears slight traces of ancient *tin-streaming*.

The streams which rise on the north-western, northern, and north-eastern slopes of Godolphin, unite with rivulets from Clowance and Skewes in Crowan; and, together, they find their way to the north coast at Hayle. At Saint Erth the

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Some forty years ago the reedy tarn which forms part of Marazion marsh abounded with water-lilies; but when operations were resumed at *Wheal Darlington* (the *Bog* mine), the entire tract was drained, and the peat it contained supplied the neighbourhood with fuel. As soon as the works were abandoned, however, the ground was again overflowed; the rootlets which had escaped the ravages of the cottagers again put forth shoots, and—after an interval of, perhaps, thirty years—leaves and flowers have lately reappeared.

* Borlase, *Natural History*, p. 99. Sedgwick, *Trans: Cambridge Phil: Society*, i, p. 111. Boase, *Cornwall Geol: Trans:* iv, p. 354. Henwood, *Ibid*, v, p. 43. De la Beche, *Report on the Geology of Cornwall*, &c., p. 162. Haughton, *Proceedings of the Royal Society*, xvii, pp. 209-11.

† Hawkins, *Cornwall Geol: Trans:* ii, p. 380. Sedgwick, *Trans: Cambridge Phil: Society*, i, p. 117. Thomas, (R.) *Mining Review*, No. ix, p. 30. Boase, *Cornwall Geol: Trans*: iv, pp. 348, 350. De la Beche, *Report*, p. 100. Henwood, *Cornwall Geol: Trans*: v, p. 47.

‡ Carne, *Cornwall Geol: Trans*: i, p. 102; ii, p. 83. Sedgwick, *Trans: Camb: Phil: Society*, i, p. 129. Boase, *Cornwall Geol: Trans*: iv, p. 354; *Primary Geology*, p. 57, *Fig.* 3. De la Beche, *Report*, p. 175. Henwood, *Cornwall Geol: Trans*: v, p. 51.

§ *Ibid*, v, p. 250; viii, p. 674; *Journal of the Royal Institution of Cornwall*, No. xiii, p. xvi.

‖ Carew, *Survey of Cornwall*, p. 153. Hitchins and Drew, *History of Cornwall*, ii. p. 116. Henwood, *Cornwall Geol: Trans*: v, p. 53; viii, p. 446. Blight, *Churches of West Cornwall*, p. 72. *Parochial History of Cornwall*, i, p. 140.

bed of this rivulet* presents the undermentioned section;†—

(1). Gravel, sand, and mud;—

(2). Peat;—

(3). Roots, trunks, and branches of trees; mixed with quantities of nuts;—and

(4). The *tin-ground*, which—although neither rich nor extensive—was wrought, near Saint Erth bridge by the use of much such a steam-engine as that worked at Marazion-march.‡

The easternmost of the two great granitic tracts in West Cornwall extends from Prospidnick and Nancegollan on the west to Ponsnooth and Budock on the east, and from near Polwheverell on the south to *Wheal Buller* on the north; and—though separated at the surface by shallow scales of slate§—the range of Carn Brea and Carn Entral as well as the hill of Carn Marth are probably connected with it at inconsiderable depths. Both granite and slate are penetrated by broad dykes of felspar-porphyry *(Elvan-courses)* which in, rare instances, contain tin-ore.|| All these rocks are traversed by metalliferous veins *(lodes)*, which maintain an average direction of about 20° N. of E.—S. of W.,¶ but, in the very same mines, other *(Caunter) lodes* bear nearly N.E.—S.W.** On and about the southern boundary of the granite tin-ore is their sole produce;—towards the east, however, tin-ore prevails only near the surface, whilst the ores of copper occur beneath;—and along the northern margin copper-ores abound at intermediate depths, but tin-ore is plentiful both above and below†† them.

Numberless rills, rising far within the granitic region, unite to

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* The gravel, sand, and slime escaping during treatment of ores at the mines worked on various tributaries of this stream, have lately been collected, near the Saint Erth Rolling-mills, and rewashed to some advantage.

† Mr. W. J. Rawlings, of Downs, near Hayle, MSS.

"The largest lump of *Jew's-house-tin* or *Jew's-bowl* I have heard of "weighed 37lbs., * *; it formed part of a hedge in the Parish of Gwinear." CARNE, *Cornwall Geol: Trans*: ii, p. 293.

‡ *Ante*, p. 198.

§ Thomas, (R.), *Mining Review*, No. viii, p. 265.

|| Henwood, *Cornwall Geol: Trans*: v, p. 37-8, 85.

¶ *Ibid*, v, p. 250; viii, p. 674.

** *Ibid*, v, p. 252.

†† *Ibid*, v, *Table* li. Thomas, (J.), *Journal of the Royal Institution of Cornwall*, iii, pp. 191-2.

form the river Cober, a principal feeder of the Loe-pool.* The swampy moorlands—portions of Carn-wartha, Mean Vroaz, Lezerea, Carth-vean, and perhaps of other, tenements—through which they find their way near Porkellis in Wendron have been wrought by Tin-streamers for many ages;† but, though their produce has greatly diminished, they are not yet quite exhausted; in many cases, however, the principal detrital deposits of tin-ore are found to have been already explored by earlier workmen.

The upper part of Carn-wartha displays;—

(1). Angular and sub-angular masses of granite and of thin quartzose and schorlaceous veins mixed with lumps of peat and quantities of granite gravel and sand;—the refuse of previous operations ..... 12 feet;—

(2). *Tin-ground.* Quartzose, felspathic and schorlaceous sand and gravel, unequally sprinkled with, more or less rounded, granules of tin-ore: interspersed, at intervals, with blocks of granite and schorl-rock, of much the same character as those in the overlying rubbish. This deposit,—now wrought for the first time—is ..... 12 feet thick;

The *Shelf*—of disintegrated granite—contains numerous small, isolated, bodies, and short, narrow, veins of quartz and schorl, irregularly impregnated with tin-ore.

In Mean Vroaz great quantities of detrital tin-ore were obtained by the *Streamers;* who—on reaching the granitic shelf—discovered the outcrop of *lodes* which were wrought, to some depth,‡ with considerable advantage.

At Lezerea the successive deposits are,—

(1). Peat; in the deeper part of which nuts and branches of hazel are sometimes found. The depth varies, but seldom exceeds ..... 4 feet;—

(2). Coarse granitic gravel containing, here and there, sub-angular *stones* of tin-ore ..... 2 to 3 feet;—

(3). Granitic sand slightly, and at intervals, mixed with felspathic clay ..... 2 „ ;—

(4). *Tin-ground.* Angular and somewhat rounded masses of granite and schorl-rock, largely mixed with tin-ore of rather different character from that obtained at Carn-wartha ..... 3 „ ;—

The Shelf—of disintegrated, felspathic, granite—maintains a tolerably uniform composition to considerable depths; but in structure the shallower portions, which afford traces of detrital tin-ore, differ materially from the deeper, which are traversed by numerous small *strings* of tinny quartz-rock.

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* Rogers, (J. Jope), *Cornwall Geol: Trans*: vii, p. 352.

† Boase, *Ibid*, iv, p. 332. De la Beche, *Report*, p. 401.

‡ Mr. Frederick Hill, F.G.S., of Penhellis near Helston, MS.

In other parts of the moor sections of ancient works show beds of detrital matter resting immediately on the outcrop of tin-bearing veins in the *(Shelf)* granite.

From Porkellis to Trenear, and thence downward to Helston, traces of *stream-works* are visible at short intervals. And from the bed of the Loe-pool tin-ore has been also obtained.*

Neither the stream—nor the mine-tin-ore presents trace of either copper—or iron-pyrites; and, throughout the neighbourhood, trout thrive in every rivulet and pool.† Generally speaking, the detrital tin-ore is less rounded in this, than in any other part, of Cornwall; and, mixed with it, water-worn granules of exceedingly pure gold‡ are sometimes, though but seldom, found.

Near Tregedna,§ in Mawnan, vegetable mould and hardened silt, to a thickness of twenty or thirty feet, overlie a very thin

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* Rogers, (J. Jope), *Cornwall Geol*: *Trans*: vii, p. 354.

† Fish of considerable size are frequently caught in the deep pits of abandoned works.

‡ Some five and thirty years ago, whilst examining a small *parcel* of *stream*-tin-ore brought from this district to one of the Smelting-houses at Hayle; I found, amongst it, a lump of gold, nearly, if not quite, as large as a pea.

§ "A mass of *Jew's-house-tin*, three or four pounds weight, was found amongst the remains of an ancient furnace, near the well at Tregedna." Mr. Joshua Fox, MS.

The public enjoy almost unlimited opportunity of observing that birds without number frequent the beautiful grounds of Tregedna; accompany Mr. Fox in his walks, alight on his person, and feed from his hand.

During my sojourn in Brazil an English resident at *Gongo Soco* presented one of my little household with a specimen of the *Merlo (? Merula minor)* a jet-black bird about the size of a starling; which had been taken from the nest, whilst yet unable to feed himself or to fly; thus early, however, he bathed after every meal. Showing no disposition to wander, he was never caged, but hopped and fluttered about the premises at will. It was impossible not to notice habits so unlike those of any other bird I had ever seen; and the interest I felt seemed to awaken some corresponding feeling in him, for he accompanied me through the garden and returned with me to the house. The little basket in which he had always slept, was now placed, at night, within reach of my bed. At dawn he awoke me by the rustling of his feathers, and if I did not leave the bed at sun-rise he hopped to the pillow and pulled my hair or tugged at my night-cap; whilst I dressed he sat on the sill of the open window and poured forth his sweet morning song.

When I left the house he betook himself to the garden, where he adroitly seized, and heartily fed on, grubs, insects, and worms, disturbed by the rake or unearthed by the shovel of the workman; great part of his time he sat and sang amongst the palms, bananas, and orange-trees; paying, however,

and exceedingly poor deposit of detrital tin-ore, and this rests on the *(Shelf)* slate of the country. The earthy matter examined and rejected by *tin-dressers* of an earlier period have been discovered

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occasional visits to the kitchen, where he helped himself to whatever he fancied. He bathed many times every day in a little pool which he had dug, for his own use, in the gravelly bed of a rill which wound through the grounds. Now and then he associated with other birds which frequented the place, but, —being somewhat pugnacious—I believe, he more commonly drove them away.

On my return to breakfast or dinner I called or whistled to him, and—if at hand—he immediately hopped on my stick when held out to him, or perched on my shoulder or my head; if further distant, however, he instantly replied, and I had scarcely seated myself before he would dart through an open window or between the branches of the flowering shrubs which shaded the veranda, and—almost brushing my face with his wings—alight on the table before me. He fed off the edge of my plate, on small bits of meat with crumbs of bread and of potatoes, but never hesitated to take anything else he desired. After he had finished his meal he placed himself (most inconveniently) between me and my plate, and was instantly asleep. His nap however was but a short one; and, on awaking, he either flitted about the room, occasionally catching flies, or walked about the table, sometimes throwing knives and forks on the floor, but, in preference, pulling the spoon out of the mustard, and—as if conscious of having done wrong—screeching as he fluttered out of reach. On my leaving the breakfast-table he usually played about me for a few minutes and then flew off to his bath in the garden. When ale was taken at dinner he watched the bubbles as they rose, and quickly peeped over the rim of the glass to see them as, in succession, they burst at the surface. But before the cloth was removed, and whilst the sun was still shining, he became drowsy and chattered for his basket, hopped into it as soon as it was brought, and was asleep in a moment.

* * * * * *

He was always the first to welcome me home from journeys which sometimes involved an absence of a day or two; and if—as was not uncommonly the case—urgent business compelled my instant attention, a tug at my hair or a pinch of the ear reminded me that I had not acknowledged his greeting. On one occasion, however, I did not return for nearly a week; and, to my surprize he was not present to receive me on my arrival. It appeared that for three or four days after my departure he had continued to take his meals, and to sleep in my bed-room, as usual; he then discontinued his visits to the house, yet had been seen two or three times in the garden; but afterwards all trace of him had been lost. Grieved—not unnaturally—at the disappearance of so interesting a favourite, I visited every walk we had usually taken together through the grounds, but without receiving a reply to the call which heretofore had brought him instantly to my side. At length I caught a faint note, which was repeated when I called again; this led me to an unfrequented part of the garden; when my poor little shrunken bird—his glossy plumage rumpled and soiled, his bright eye half-closed and dim—crept feebly from beneath a fallen banana-leaf; and, with every demonstration of pleasure, took his accustomed place on my walking-stick. On

in the neighbourhood, but whence the ore was obtained is now unknown.*

Between Higher Carnon and Restronguet-creek the largest known body of detrital tin-ore has been wrought—at intervals within my recollection—by five several parties of speculators in succession; by the first two as open-works;† but by the other three in shafts‡ sunk deeper than the bed of the inlet, and by drifts in which the miners worked whilst laden ships sailed over head.§

About the middle of the navigable channel near Point,—where

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returning to the house he resumed his station at the table, and again occupied his basket in my bedroom.

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My pretty, engaging, and affectionate companion died whilst moulting; and was buried beneath a flowering-shrub, which he had loved to frequent.

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His grave was the last spot I visited in Brazil; and I still preserve the spray from which he carolled, and a feather of his wing.

* A mass of *Jew's-house-tin*—since placed in the Museum of the Royal Institution of Cornwall—was discovered, by Mr. Cuttance, at Trenower in Saint Martin, a south-eastern Parish in the (Lizard) Meneage district, some miles from any now-known habitat of tin-ore, and far beyond the confines of this region. Dr. Jago, M.D.; F.R.S.; MS.; *Report of the Royal Institution of Cornwall*, xlv, (1863), p. 18.

† The last of the *open-works* afforded a profit of about.....£50,000.

‡ The first of the *Mining-works* afforded a profit of about....£2,8000.
The second ,, ,, eventuated in a loss of about....£16,000.

Trebilcock, Michell, and Cloak, *Cornwall Geol: Trans*: viii, p. 452, *Table*, xiv.

§ The [open] stream-works "were found sufficiently profitable to induce "the adventurers to extend their operations down the navigation nearly a "mile and a half....[But] latterly the work has been carried on in another "way;....a shaft was sunk in the firm rock of the shore, and a drift was "extended from the bottom,....by which means the tin was obtained by "removing only a small part of the great mass of mud which covered it.... "These operations have been sufficiently successful, to induce the adventurers "to extend their works half a mile further down; two shafts having recently "been sunk through the mud in the middle of the creek, and secured by "lining them with iron cylinders. The lower shaft....is surrounded by an "artificial island formed of stones and rubbish, on which is erected a steam-"engine." Thomas, (R.), *History of Falmouth*, p. 31.

the bed of Restronguet-creek is some twelve feet below high-water at spring-tide—a shaft has lately been sunk through the undermentioned deposits,—*

(1). Mud of the river (very soft) ..... 6 feet;—
(2). Mud and coarse sand ..... 8 „ ;
(3). Mud (hardened) ..... 6 „ ;
(4). Mud, mixed with great quantities of Oyster-shells ..... 12 „ ;
(5). Mud (hardened) ..... 31 „ ;
(6). *Tin-ground* (6 inches to 6 feet) .....mean 4 „ ;
The *Shelf;* homogeneous blue or buff-coloured clay-slate.

Another section, in the same neighbourhood, presents,‖—

(1). Soft river-mud ..... 7 to 9 feet;—
(2). River-sand and mud..... 9 „ ;
(3). Blue mud mixed with Oyster, Cockle, and other shells ..... 9 „ ;
(4). Stiff blue mud, without shells..... 36 „ ;
(5). *Tin-ground* (Subangular masses of granite, slate, *elvan*, quartz, quartzose slate-*capel*, and tin-ore in large masses, plentifully interspersed with smaller grains ..... 6 inches to 6 „ ;
(6). The *Shelf;* clay-slate.

The tin-ground was no where else so rich as at the confluence of the Carnon valley with the vales which extend respectively through Perran-Wharf and Ponsnooth to the northern slope of Carn Menelez, and from Tarnon-dean through Perran-well (the Smelting-house glen) to Gilly.† As might have been anticipated, operations were undertaken in both; but—as speculations—they were alike unsuccessful; through, incidentally, they were of great interest.

At perhaps one-third of the distance between the Carnon embankment and Perran-wharf an artificial mound was raised above the level of high-water; and, through it, a shaft penetrated to the *(shelf)* rock, whilst drifts were extended, laying open both the tin-ground and the bed of vegetable matter above it. As the works were imperfectly ventilated, inflammable gas sometimes accumulated; and—more than once—the workmen, who worked with unprotected candles, were scorched by its explosion.‡

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* For these particulars I am indebted to Mr. Richard Taylor, F.G.S.; and Mr. Charles Dyke Taylor.

† For this section I have to thank Mr. Whitley, C.E.; F.M.S.; Secretary of the Royal Institution of Cornwall.

‡ Henwood, *Cornwall Geol*: *Trans*: v, p. 60.

§ *Ibid*, viii, p. 453.

Some forty-five years ago* the surface of Perran-Well (Smelting-house) vale, at its confluence with the principal valley, was from four to six feet below the level of the highest tides;† from these, however,—as at the upper part of Carnon in earlier years—it was protected by an embankment, and wrought as an *open-work*. The ingredients with which it was then filled, to a depth of sixteen or eighteen feet, consisted of—

(1). Angular gravel, sand, and silt, the *débris* of various rocks and vein-stones stamped in upper parts of the principal valley, mixed with rounded masses of granite and slate from the neighbourhood; in numberless beds of unequal—but never of very great—thickness.. 12 to 15 feet;
At a considerable depth in this deposit the remains of deer occurred; and still deeper Oyster-shells were numerous.

(2). Fine silt, mingled with Oyster-shells, leaves, nuts, and branches of trees, amongst which the wing-cases of beetles might sometimes though very rarely be discerned ..... 6 to 18 inches;

(3). *Tin-ground;* consisting of small—more or less rounded—bodies of tin-ore; interspersed with angular and subangular blocks of schorl-rock, schorlaceous-granite, quartz, quartzose-slate, and other vein-stones of both the granite and the slate series of the district in much greater abundance ..... 2 to 3 feet;

The Shelf; of homogeneous, thick-lamellar, clay-slate, of silky lustre; traversed, almost meridianally, by a quartzose *cross-vein*, which was wrought throughout the entire width of the vale; and—some twelve or fifteen fathoms below the tin-ground—yielded considerable, though not quite remunerative, quantities of argentiferous lead-ore.

Granules and thin flakes of gold‡ were now and then—though very uncommonly—found in the tin-ground.

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* Pryce, *Mineralogia Cornubiensis*, p. 136. Thomas, *History of Falmouth*, pp. 48, 51. Barham, (C.). *Reports of the Royal Institution of Cornwall*, xlii, (1860), p. 16. Francis, (W.), *Gwennap; a Descriptive Poem*, p. 7. Henwood, *Journal of the Royal Institution of Cornwall*, iii, (1870), p. xvii.

† At Falmouth "average spring-tides may be considered as having a "rise and fall of 16 to 17 feet; and these rise to about 18 feet, and fall of "about 1½ feet, above the lowest veers. The neap-tides average a rise and "fall of about 7 feet, being at high-water, about 14 feet, and at low-water "about 7 feet, above the lowest veers." Thomas, (R.), *History of Falmouth*, "p. 43.

‡ "A piece of gold, in a matrix of quartz, from Carnon Vale, in the Royal "Institution of Cornwall, weighs 11 dwts. 6 grs." Michell, (J.), *Manual of "Mineralogy*, p. 2.

"Gold was found in the bed of the brook from Tarnon-dean upwards as far as Trewedna-water." Francis, (W.), *Gwennap; a Descriptive Poem*, p. 94.

My home was less than half a mile from this rivulet; but that any part of its course had been found auriferous, I never heard until now.

The remains of an ancient smelting-furnace, and of block-moulds in the rock are said to have been discovered between Pulla and Higher Coisgarne, in Gwennap;* and in the east of Kea a mass of Jew's-house-tin was found.†

About half-way from Tarnon-dean to the Arsenic manufactory,—towards the middle of the vale,—and at sixteen or eighteen feet below the surface, some two or three tons of large, rough, angular masses of quartz,—closely resembling those imbedded in the sub-soil of the neighbouring common were found resting on the bed (2) of silt, shells, and vegetable matter. Immediately beneath the stones,—and within compass of the layer of animal, vegetable, and mineral substances on which they rested—at some

SKELETON

Discovered resting on the TIN-GROUND

BETWEEN TARNON-DEAN AND THE ARSENIC-WORKS, PERRAN-AR-WORTHAL.

DRAWN BY MR. H. M. GEOFFROI.

From a Sketch by the late REVEREND CANON ROGERS, M.A., of Penrose.

* "Some years ago Mr. Polkinghorne discovered [near Higher Cois-"garne-mill] an ancient furnace where tin was smelted and formed into "blocks. The furnace contained a large quantity of charcoal-ashes and "half-burnt wood; and the moulds for forming the metal into blocks were "found cut in the rock." FRANCIS, *Gwennap; a Descriptive Poem*, p. 100. *Parochial History of Cornwall*, p. 143.

† "Muriate of tin was first discovered in a specimen of Jew's-house-tin "....found in a low boggy ground in the Parish of Kea, accompanied by a "stratum of charcoal." MICHELL, (JOHN), *Manual of Mineralogy*, p. 74.

twenty-two feet below high-water, and four or five above low-water mark,* an entire human skeleton was discovered.

A rough balk, of about eight feet in length and six or eight inches in thickness, rudely hewn at the ends, lay on either side of,—nearly parallel to—but at some little distance from the body; that on the left resting on the—slightly extended—hand. Across these were placed two, somewhat similar, beams; one of which pressed on the lower ribs, whilst the other covered the mouth and chin. A third cross-bar, of much the same kind,—so much shorter that it did not reach either of the side-pieces,—rested on the (raised) right-hand, but scarcely touched the skull. No corresponding piece of timber, however, had been placed at the foot. The body lay on its back, inclined perhaps five or ten degrees from the horizon, and looked towards the north or north-north-west; the knees were raised, and the legs so drawn back that they were nearly parallel to the thighs, the heels, in fact had almost touched the hams; the right-arm extended obliquely above the head, the left—at a smaller angle—downwards.† The pelvis, other bones, and undecayed—but much-worn—teeth, shewed the remains to

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* Thomas, *History of Falmouth*, p. 31. *Ante*, p. 17.

† I am favoured, by Messrs. Heard, with the following extract from the *West Briton* of the 4th of April, 1823:—"On Saturday [the 29th of March, "1823] as the labourers employed at Carnon stream-works were removing "a quantity of mud, they discovered a heap of stones, under which were "four pieces of oak enclosing a human skeleton, the teeth and larger bones "of which were in nearly a perfect state. The tomb was covered with a "deposit of mud 17 feet in depth, and was 22 feet below the present [high] "water mark, on what is denominated the "tin-ground," namely, stones "mixed with gravel amongst which tin is found. The four pieces of oak are "each about 8 feet in length, roughly hewn, and about 8 inches in diameter. "One of these pieces lay on each side of the body; the other two were laid "across these, over the breast, the stones were piled over the whole. The "wood is more decayed than the timber found in these stream-works "usually is."

To the Reverend Saltren Rogers, M.A., Vicar of Gwennap, I am indebted for the following contemporary memoranda, and for the sketch from which the accompanying wood-cut was prepared, discovered by his brother, Mr. John Jope Rogers, of Penrose, amongst the papers of their late father the Reverend Canon Rogers, M.A.

From a printed paper; apparently part of a Newspaper; dated 7th of April, [1823.]

"The skeleton was found in a bed of soft clay containing shells, 17 feet "below the surface, 22 feet below high-water mark, and one foot above the "*tin-ground*, lying in a direction across the valley, with the head nearly

be those of a man, not exceeding five feet five inches in height, and, probably, much beyond middle-age.*

SKULL

Of the Skeleton discovered at

PERRAN-AR-WORTHAL.

From a Photograph by Argall, of Truro.†

" south, and the feet nearly north. A piece of rough elm was placed at the " head, and a piece of the same cut to the length of 8 feet, on each side of " the skeleton, two pieces of the same length were placed at right-angles, " one across the head, and the other across the breast. No wood was placed " at the feet. The circumstance most worthy of remark is the posture of " the skeleton. The head and breast were a little raised above the rest of " the body. The left arm was extended a little from the side, and *the piece " of elm on that side rested on the hand.* The right arm was raised with the " hand above the head; and *the elm head-piece rested on the hand.* The knees " were inclined upward.... and the feet were bent back under the top of the " thigh-bones, and *rested on the tin-ground.* The skull, ribs, and all the " bones appeared on close examination to be perfectly sound, except a partial " decay of a few of the vertebræ, and were not at all mineralized. A pile of " stones was heaped on the skeleton, containing five barrows-full; some of " the largest were computed to be about 70 or 80lbs. weight."...." The skull, " teeth, horns, and some vertebræ of a stag of the red-deer species have " been since found near the spot, about eight feet below the surface." " No " hair, cloth, or any other substance, except the elm, was found near the " skeleton."

From Manuscript Notes, which accompanied a Sketch, by the Reverend Canon Rogers, M.A.

" The elm was eight feet long and six inches thick, cut off at both ends with an axe....The pile of stones was two feet high."

* For these particulars I am indebted to my friend DR. JAGO, F.R.S.; who was assisted in his enquiries by Mr. E. Sharp, M.R.C.S.; and Mr. A. L. Salmon, M.R.C.S.

† Taken under the direction of DR. JAGO, F.R.S.

Of clothing, ornament, tool, or weapon no trace was discovered.

The works were carried on by a Company* which had recently established, in the immediate neighbourhood, the first manufactory of *white arsenic* (arsenious acid)† in the United Kingdom; and both were superintended by Mr. John Rowse,‡ a person of much information, sagacity and prudence. The stones, gravel, and silt were, therefore, carefully removed, and the skeleton as well as the wood which surrounded it, were scrupulously protected from displacement, until they had been carefully examined. And in order to satisfy the deep and general interest which prevailed, the remains were, for some time, open to public inspection; and—as my home was scarcely a mile distant,—I visited the spot daily. At length the skeleton was taken into safe keeping; and in 1827 it was presented to the *Royal Institution of Cornwall.*

The central district,§ which attains, at Hensbarrow, an elevation of more than a thousand feet,‖ consists of granite, of slate sometimes interlaid with hornblendic rocks¶ sometimes charged with organic remains,** and of *elvans* intersecting both granite and slate. A considerable part of this region affords the slightly-coherent talcose granite,†† whence the manufacturers of porcelain,

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* Boase and Courtney, *Bibliotheca Cornubiensis*, i, p. 136.

† Henwood, *Cornwall Geol: Trans:* v, p. 86.*

‡ *Ibid*, iv, p. 162.

§ This district is bounded by a line drawn from Wadebridge to Lostwithiel; and by another line through Truro-river to the Gannel. Boase, *Cornwall Geol: Trans:* iv, p. 234.

"Lanivet Tower, two miles west of Bodmin, is by common repute the centre of Cornwall."

Wallis, *Bodmin Register*, p. 103; *Cornwall Register*, p. 199.

‖ *Trigonometrical Survey.* De la Beche, *Report on the Geology of Cornwall, &c.*, pp. 7, 14.

¶ Boase, *Cornwall Geol: Trans:* iv, pp. 262, 276. De la Beche, *Report*, p. 82. Phillips, (J. A.), *London, Edin: and Dublin Phil: Mag.*, xli, pp. 97, 99.

** De la Beche, *Report*, p. 351. Henwood, *Cornwall Geol: Trans:* v, pp. 125, 158.

†† Bonnard, *Journal des Mines*, xiv, p. 448. Deluc, *Geological Travels*, iii, p. 342. Berger, *Geol: Trans:* (O.S.), i, p. 125. Thomson, *Annals of Philosophy*, ii, p. 349. Fitton, *Ibid*, iii, p. 180. Conybeare, (J. J.), *Ibid*, v, p. 186. Dufrénoy, De Beaumont, Coste et Perdonnet, *Voyage Métallurgique en Angleterre*, ii, p. 187. Boase, *Cornwall Geol: Trans:* iv, p. 235; *Phil: Mag: and Annals*, x, p. 348. Hawkins, *Cornwall Geol: Trans:* iv, p. 475. De la Beche, *Report on the Geology of Cornwall, &c.*, pp. 159, 509. Henwood, *Cornwall Geol: Trans:* v, p. 115.

as well on the Continent as throughout the United Kingdom, procure most of their materials.* Throughout the granitic tract schorl is more or less abundant; and, here and there, it prevails;† generally, however, associated with quartz or with felspar, and sometimes with both. Nor are associations of schorl with quartz and felspar peculiar to rocks of massive structure; for the same substances—especially the first two—are not uncommon, in their alternations displaying every imaginable involution and displacement, amongst the slates which adjoin the granite.‡ Westward the schistose rocks are mostly of dark blue and greenish grey hue, and their structure is thick lamellar, but occasionally they cleave rather imperfectly.§ Eastward, however, they assume various shades of pale-blue, greenish-grey, red, and dark brown, and here their cleavage is more decided, and their texture softer.‖ To-

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* The following columns show the enormous increase in the export of China-stone and China-clay which has lately taken place.

Years.	China-stone.	China-clay.
1809	1,162 tons	1,757 tons.
1816	2,135 ,,	1,775 ,,
1826	5,000 ,,	7,490 ,,
1838	7,344 ,,	20,784 ,,
1858	21,983 ,,	83,113 ,,
1868	29,000 ,,	100,000 ,,
1870	32,500 ,,	110,520 ,,

Lysons, *Cornwall*, p. ccxi. *Cornwall Geol*: *Trans*: i, p. 233; iii, p. 360; v, p. 478. Hunt, *Mineral Statistics*, 1858, p. 2; 1868, p. 139; 1871, p. 443.

† Deluc, *Geological Travels*, iii, p. 343. Conybeare, (J. J.), *Annals of Philosophy*, v, p. 188. Von Oeynhausen and Von Dechen, *Phil*: *Mag*: *and Annals*, v, p. 241. Sedgwick, *Proceedings of the Geological Society*, i, p. 283. Boase, *Cornwall Geol*: *Trans*: iv, p. 238. Hawkins, *Ibid*, iv, p. 476. Henwood, *Ibid*, v, p. 122. De la Beche, *Report*, p. 159.

‡ "On the confines of the granite...alternate layers generally of great "tenuity, of very minutely granular quartz and schorl, have all the aspect "of a stratified mass." Conybeare, (J. J.), *Annals of Philosophy*, v, p. 189.

"A very interesting form of this rock consists of alternating layers of "black and white minerals, exhibiting the most complicated curves and con-"tortions....The black are of...schorl-rock, the white of quartz which is "generally more or less combined with felspar....This kind of schorl-rock "is very abundant in the diluvium on Tregoss Moors." Boase, *Cornwall Geol*: *Trans*: iv, p. 245.

§ Boase, *Ibid*, iv, pp. 275, 278. Henwood, *Ibid*, v, p. 125. Phillips, (J. A.), *London, Edin*: *and Dublin Phil*: *Mag*., xli, p. 90.

‖ Boase, *Cornwall Geol*: *Trans*: iv, p. 286. Henwood, *Ibid*, v, p. 125. De la Beche, *Report*, pp. 80, 82.

wards the south-east they assume an arenaceous character, and are charged with organic remains.* The *elvans* which traverse the western—but do not reach the eastern†—part of this district, are well known, and have been frequently described.‡ The *lodes* take a mean direction of about 13° N. of E.—S. of W.,§ but—as in other regions—they are not strictly parallel; their divergences, however, are by no means uncommon. Throughout the County their average dip is about 70°, but in this neighbourhood it scarcely exceeds 60°.‖ In the massive-felspathic, and soft schistose, rocks on the E. and S.E. they yield copper-ore only;¶ but in the hard, quartzose, thick-lamellar slate, in the schorl-rocks, and in the granite towards the N. and W.—though they are sometimes sprinkled with the compounds of nickel, of cobalt, of uranium,** and of antimony—tin-ore prevails.†† But *lodes* are not only the repositories of tin-ore; for in this neighbourhood‡‡

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* De la Beche, *Report*, p. 351. Henwood, *Cornwall Geol*: *Trans*: v, pp. 125, 158.

† Henwood, *Cornwall Geol*: *Trans* v, p. 126.

‡ Bonnard, *Journal des Mines*, xiv, p. 446. Hawkins, *Cornwall Geol*: *Trans*: i, p. 150, *Pl.* 5. Boase, *Ibid*, iv, pp. 277, 279. Henwood, *Ibid*, v, pp. 126, 160. De la Beche, *Report*, pp. 181, 332.

§ Henwood, *Cornwall Geol*: *Trans*: v, p. 250, *Table*, ciii; *Journal of the Royal Institution of Cornwall*, No. 13, p. xvi. De la Beche, *Report*, p. 305.

‖ Henwood, *Cornwall Geol: Trans:* v, p. 247; *Annales des Mines*, 6me Série, ii, p. 172.

¶ De la Beche, *Report*, p. 335. Henwood, *Cornwall Geol*: *Trans*: v, p. 128.

** Williams, (R. H.), *Reports of the Royal Institution of Cornwall*, xxxix, p. 32.

†† Borlase, *Natural History*, p. 18. Jars, *Voyages Métallurgiques*, iii, p. 108. Bonnard, *Journal des Mines*, xiv, p. 446. Hawkins, *Cornwall Geol*: *Trans*: i, p. 146; iv, p. 476. Carne, *Ibid*, ii, p. 92. Von Oeynhausen and Von Dechen, *Phil*: *Mag*: *and Annals*, v, p. 241. Sedgwick, *Ibid*, ix, p. 284. Boase, *Cornwall Geol*: *Trans*: iv, p. 276. Henwood, *Ibid*, v, p. 120, *Tables*, lxxxiv, lxxxv.

‡‡ "Il existe pour ainsi dire partout, aux environs de Saint Austell, soit "à la surface, soit à quelque profondeur, dans la plus grande partie des "plaines incultes, où il y a de petits filets d'eau. On peut, en prenant une "pelletée de la terre tourbeuse, qui est à la surface, et l'exposant au courant "du ruisseau, obtenir par le lavage une quantité sensible de minerai d'étain "en particules très-fines, qui se précipitent tout de suite, et que l'on purifie "par plusieurs lavages successifs. C'est aussi ce que l'on fait dans beaucoup "d'endroits avec bénefice." Bonnard, *Journal des Mines*, xiv, p. 450.

especially,—and to a less extent in several other districts*—it is scattered through—and, so to speak, forms an integrant part of—the granite;† and in the slate series, north of the granite, tin-ore is interlaminated with schorl and quartz.† All—save one of—these spots have, however, remained unwrought for many years. In, and on the confines of, the district iron-ores abound.‡

The detrital deposits of tin-ore on the west and south have been often and minutely described,§ but they are now nearly if not quite exhausted; those towards the north and east have however, attracted less notice,‖ and on some of them operations are still carried on.

A comparatively low ridge of slate stretches—some 30° W. of N.—E. of S.—from the granite of Hensbarrow¶ to that of Belovely Beacon, dividing the upper waters of the Roche (Par)

"Carclase tends to unfold the origin of the tin-ore scattered in grains "over the bottom of some of the Cornish valleys;...the whole mass of the "*growan* composing the eastern part of the hill, contains these grains....The "strata containing the greatest abundance of tin grains are harder [than the "rest] but they are easily decomposed." De Luc, *Geological Travels*, iii, p. 342.

"The enormous open-work of Carclase is excavated in a variety of "decomposing stanniferous granite or schorl rock." Sedgwick, *Trans*: *Cambridge Phil*: *Society*, i, p. 108.

Sedgwick, *Geol*: *Trans*: iii, (N.S.), p. 483. Henwood, *Cornwall Geol*: *Trans*: v, p. 119.

* On Dartmoor (Berger, *Geol: Trans:* i, (O.S.), p. 120); at Saint Just (Henwood, *Cornwall Geol*: *Trans*: v, pp. 15, 235); in Breage (*Ibid*, p. 53); and at St. Cleer (*Ibid*, viii, p. 664.)

† Boase, *Cornwall Geol: Trans*: iv, p. 252. Henwood, *Ibid*, v, p. 120 Note*.

‡ De la Beche, *Report*, pp. 303, 617. Henwood, *Cornwall Geol*: *Trans*: v, p. 128.

§ *Ante*, p. 3.

‖ Henwood, *Cornwall Geol*: *Trans:* iv, p. 60. De la Beche, *Report*, p. 405.

¶ Hensbarrow ....is 1,034 feet above the sea;—
Killivreth Down ,, 1,000 ,, ,,
Castle an Dinas ,, 729 ,, ,,
Belovely Beacon ,, 765 ,, ,,
Helmen Tor ,, 687 ,, ,,

De la Beche (Maclauchlan), *Report*, pp. 14, 16.

river from those of the Fal;* but both flow southward into the British Channel.† A similar, but perhaps a rather lower range, of like character extends—perhaps 25° E. of N.—W. of S.—from the granite near the Indian Queens to that of Castle an Dinas;* thus separating the tributaries of the Ladock rivulet—a branch of the Fal—from those of the Gannel and of the (Saint Columb-minor) Porth brook; both which run northward to the Bristol Channel.

As the Roche river is traced upward through the moors north-east of Hensbarrow the *stream-works* mentioned hereafter are passed in succession.

At *Pendelow* in Saint Austell the detrital deposits—wrought since 1828‡—now present the undermentioned section;—

(1).	Granitic sand and gravel, divided by thin partings of hardened silt into many separate beds	6 to 8 feet;—
(2).	Peat *(fen)*; often mixed with, and sometimes interlaid by microscopic layers of,§ granitic sand	0·3 foot ,, 2 ,, ;—
(3).	Granitic sand and gravel in many thin layers; the lower of them much mixed with hardened mud.	7 ,, 8 ,, ;—
(4).	Peat, very closely resembling No. 2.....	1 foot;—
(5).	Granitic sand and gravel, scarcely differing from No. 1	3 to 6 inches;—
(6).	Peat§; sometimes mixed with stems of fern, nuts, leaves, branches of furze, alder and hazel, and trunks of oak. Here and there, but very rarely, a few flints have been discovered.....	1 foot;—
(7).	The *tin-ground*, consisting of granitic, schorlaceous and quartzose matter mixed with the oxide of tin, usually in the state of sand and gravel; but sometimes it includes subangular masses of various granitic rocks and vein-stones; and—yet more rarely—thin scales of slate also.....	2 to 4 feet;—

The *(Shelf)* rock beneath is granite of ordinary texture, sometimes moderately hard, but usually more or less disintegrated; in such cases, however, it is often deeply eroded, and in these erosions the ore is often richer than in the *tin-ground* proper.

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* Polwhele, *History of Cornwall*, i, p. 183. Lysons, *Cornwall*, p. clxxxvii. Gilbert, (C. S.), *Historical Survey of Cornwall*, i, p. 405. Hitchens and Drew, *History of Cornwall*, i, p. 521. *Ante*, p. 24.

† Thomas, (R.), *History of Falmouth*, p. 15.

‡ Henwood, *Cornwall Geol*: *Trans*: iv, p. 63.

§ Specimens of this peat were obligingly submitted to microscopic examination by Mr. Ralfs, F.R.C.S.

Levrean, in the same parish, now displays;—

(1). Granitic sand and gravel ..... 1 foot;—

(2). Peat *(fen)*; often mixed with, and sometimes divided by exceedingly thin layers of, granitic sand..... 1 „ ;—

(3). Granitic matter *(the Upper tin-ground)*; small subangular masses of felspar, quartz and white mica, mixed largely with schorlaceous matter, with particles and granules of tin-ore in smaller proportions, and, in rare instances, with minute specks of gold .. 3 to 6 feet;—

(4). Angular and subangular masses of granite imbedded in granitic sand; altogether destitute of tin-ore *(False shelf*)* ..... 1 „ 1·3 foot;—

(5). The *tin-ground*, comprehending angular and subangular bodies of granite, felspar, quartz, schorl, and various vein-stones, mixed with granitic gravel and sand, as well as with grains and particles of oxide of tin; and, still less frequently, with flakes of schistose matter and specks of gold .....10 to 15 feet;—

A few ancient shovels—some made wholly of wood, others bound at the edges with iron†—have been found, from time to time, in distant parts of this bed.

The *(Shelf)* granite beneath is of ordinary texture, unequal hardness, and, generally of reddish hue; its surface is remarkably uneven, and the depressions in it are often the richest repositories of tin-ore.

At *Pit-moor*, also in Saint Austell, the successive deposits consist of;—

(1). Vegetable mould ..... 1 foot;—

(2). Granitic sand and gravel, in many separate layers, but all of like character ..... 2 to 3 feet;—

(3). „ „ mixed with subangular masses of granite and of schorl-rock..... 3 „ ;—

(4). The *tin-ground*, made up of angular, subangular, and rounded masses of granite, quartz, schorl-rock, and schorl, with similar bodies of various vein-stones and small quantities of tin-ore, of different sizes, but mostly very small. Laminæ of clay-slate are sometimes, but very rarely, mixed with the other ingredients ....3 to 10 feet;—

The granitic matter *(Shelf)* beneath, is of ordinary texture, but usually it is very soft, so soft, indeed, that portions of it—on being laid open—flow forth in a semi-liquid state.

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* Henwood, *Cornwall Geol*: *Trans*: iv, p. 62.

† The workmen use "a broad Shouell, the vtter part of yron, the middle "of Timber, into which the staffe is slopewise fastned." Carew, *Survey of Cornwall*, f. 10.

Pendelow is drained by aid of a water-wheel about six feet in diameter; from *Levrean* and *Pit-moor* the water escapes through open drains.

The bed and banks of a brook which rises in Red-moor, north-east of Helmen-Tor,* bear—near its confluence with the Roche river—traces of having been ransacked at some earlier period; but at present they remain unwrought. Nearer to its source, however, operations—though on a very small scale—are still continued.† But, notwithstanding they are within two miles of *stream-works* still in progress on the moors of Saint Austell, and occupy neighbouring portions of the same granite, the detrital deposits worked in them are of widely different character.

Lower Creany, a part of Red-moor, in Lanlivery, exhibits;—

(1). Peat ..... 2 to 3 feet;—

(2). Granitic (though slightly quartzose) clay of greyish hue, mixed with laminæ of slate .....1 foot to 3 „ ;—

(3). The *tin-ground*, composed of angular, subangular and spheroidal masses of pale-brown quartz, fragments of felspar, mottled—dark-blue and yellowish-brown—clay, and granitic gravel; thinly mixed with rounded masses of tin-stone and both perfect and fractured crystals of tin-ore. Flints of considerable size occur at intervals, and particles of gold less frequently ..... 4 to 5 feet;—

The roots of marsh-plants penetrate, to a depth of 2 or 3 feet, into the *tin-ground*.

The *Shelf*,—of pale buff-coloured clay—presents a very uneven surface.

At *Upper Creany (Wheal Prosper)*—in the same parish, and, indeed, in an adjoining part of the same swamp—the order of succession is;—

(1). Peat‡ ..... 6 inches;—

(2). Granitic clay, frequently mixed with laminæ of yellowish slate .....1 foot to 3 feet;—

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* "The *Helmen Tors*...display...one or two secondary Logan rocks." *Parochial History of Cornwall*, iii, p. 32.

† 'In 1853, a curious image, about nine inches high, made of tin, and "representing a man, was found nine feet beneath the ground in a Jew's "house or stream work in Lanlivery parish. It weighed 9 lbs., and had "some Hebrew [characters] on it." ALLEN, *History of Liskeard*, p. 27. Note.

‡ Some few years since this peat was quite three feet thick; but, of late, the neighbouring cottagers have taken great part of it for fuel.

(3). The *tin-ground*, including small angular and rounded bodies of ferruginous and milk-white quartz, masses of crystalline felspar, and of granitic matter, of quartzose and schorlaceous vein-stones, and of tin-stone, all in the state of sand and gravel, mixed with minute unfractured crystals of tin-ore. Microscopic particles of gold are sometimes scattered through the other ingredients ..... 4 „ 5 feet;—

The roots of marsh plants penetrate the *tin-ground*.

The *Shelf*—of mottled blueish and brownish clay—exhibits frequent and deep undulations; in the hollows of which the *tin-ground* is usually most productive.

The works are drained by aid of a water-wheel four feet in diameter.

The Tregoss moors approach the granite of Castle an Dinas and of Belovely Beacon on the north, and that of the great eastern-central range on the south, without actually touching either.*—They are bounded towards the north-north-west and north-north-east by slight elevations—scarcely to be called *ridges* —of slate, which direct their drainage to the Fal. The entire tract is within the slate-series; but in many spots the rock is so soft that it bears scarcely a trace of schistose structure, and much of it is, in fact, mere laminated clay.† The slate is traversed by several *(Elvan-courses)*‡ porphyritic dykes composed, in great part, of felspar and quartz; one of which is slightly sprinkled with tin-ore at its outcrop.§ *Lodes* have been wrought in several parts of the neighbourhood; but, hitherto, with little success.‖

Some forty or fifty years ago the Tregoss Moors¶ exhibited an almost countless succession of low, stony, hillocks, and deep, weedy, pools, the abandoned scenes of earlier operations.** Amongst

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* Boase, *Cornwall Geol: Trans:* iv, p. 248. De la Beche, *Report*, p. 86.

† Boase, *Cornwall Geol: Trans*: iv, p. 248.

‡ De la Beche, *Report*, p. 180.

§ *Postea*, p. 29.

‖ Boase, *Cornwall Geol*: *Trans:* iv, p. 250. Henwood, *Ibid*, p. 235.

¶ I am indebted to the kindness of Mr. Whitley, C.E., F.M.S., for a copy of his instructive Geological Map of the Tregoss-moors; and to Mr. H. Michell Whitley, C.E., for a tracing from a survey made, some forty years ago, by the late Mr. Richard Thomas, C.E.

** At some distance from both their cottages and their work the *Tin streamers* build little turfen shelters for the nests of their *store*-geese. As soon as they are hatched, therefore, the goslings find suitable food in neighbouring pools, marshes, rills, and scattered patches of grass. As harvest approaches some two or three thousand young geese are sold off the moors to farmers, who fatten them on the stubbles of several adjoining parishes.

them, however, many small *tin-stream-works* were still industriously wrought, by speculative workmen, either on ancient *detritus (whole-ground)*, or on matter imperfectly gleaned by their predecessors. The works were drained either by *open-cuttings*;—by hand-pumps;—or by little *lifts* worked by water-wheels, which seldom exceeded, and were often less than, six feet in diameter. Great part of the tract—at length exhausted of tin-ore—has been, for some time, successfully cultivated, and in the portion yet unenclosed a few inconsiderable spots only are now under treatment.

On the northern side of the Moor three sections are still open to inspection.

At *Golden-stream*, about half a mile south-east of Castle-an-Dinas, in Saint Columb-major, ancient works, which have been lately resumed, exhibit—

(1). Vegetable mould ..... 6 inches;—

(2). Angular and subangular masses of slightly micaceous clay-slate, compact and thick-lamellar schorl-rock,* quartz, many vein-stones of the slate series, and here and there a stone of granite mixed with felspathic clay, and other disintegrated ingredients of the almost-adjoining *elvan-course* ..... 5 to 6 feet;—

Large lumps of peat are imbedded in portions of this *detritus* which had been previously moved.

(3). The *tin-ground* scarcely differs from the matter which overlies it, except that *elvan* is more abundant, and that small proportions of tin-ore—usually in a state of gravel or sand, but sometimes as minute unfractured crystals—are mixed with the other ingredients 2 ,, 3 ,,

The *Shelf*—at the part now under treatment—is disintegrated *elvan* containing, here and there, a few particles of cassiterite.

Wet and Dry almost adjoins *Golden-stream*, and differs from it so slightly, that a repetition of the same detail seems unnecessary.

Immediately north-west of a railway-bridge over the high-road between Lanivet and the Indian Queens, both the refuse of earlier *streamers* and unwrought *(whole)-ground* are now laid open in the

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* "Felspar, quartz, and shorl, either uniformly mixed and blended together, or arranged in alternate stripes and layers [occur at] Castle-en-Dinas, and the adjacent hills which bound the Tregoss Moors on the north." Boase, *Cornwall Geol*: *Trans*: iv, p. 253.

same broad, shallow, pit.* The undisturbed portion consists of,—

(1). Vegetable mould ..... 6 inches to 1 foot;—
(2). Angular and subangular bodies of quartz, clay-slate, laminated schorl-rock, *elvan*, and of various vein-stones from the slate formation, with—here and there, but very rarely—a few stones of granite..... 3 „ „ 4 feet;—
(3). The *tin-ground*, which closely resembles the *overburden*; save that it is thinly mixed with both rounded masses and perfect crystals of tin-ore, but all of exceedingly small size .. 1 foot to 2 feet;—

The *Shelf* consists of clay-slate, moderately hard and very fissile in some places; but in other it is merely laminated clay.

The hamlet of Tregoss and the tenement of Pendean occupy (so to speak) a peninsula, which projects, from the eastern end, far through the middle of the moors. Though scarcely higher than many heaps of rubbish left by early workmen, it bears neither trace of erosion nor fragment of detritus.†

On central portions of the region operations have been, long since, discontinued; but towards the southern margin—where detrital deposits approach the eastern-central range of granite—a few workmen still glean small quantities of *stream-tin-ore* as long as—but no longer than—the rains of winter and spring supply them with water.

At *Gun-deep*, in Saint Dennis, a pit has been sunk through—

(1). Vegetable mould ..... 6 to 12 inches;—
(2). A mixture of micaceous clay-slate, laminated schorl-rock, quartzose slate, quartz, *elvan*, and occasional stones of granite ..... 4 feet;—
(3). Peat ..... 1 foot;—
(4). The *tin-ground* was not thought worthy of being wrought.

At *Gaverigan*—a south-western part of Tregoss moors—near the confines of Saint Dennis and Saint Columb-major,‡ a mixture of angular, subangular, and rough spheroidal masses of various rocks

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* Now (1873) wrought by William Tellum and John Moss.

† "Several patches on these moors are, indeed, enclosed, and brought into tillage; such parts, however, are higher than the general surface of the moor, to which circumstance their superior fertility may be owing, the more elevated ground having been exempted from the diluvium that covers the lower levels." Boase, *Cornwall Geol*: *Trans*: iv, p. 248.

‡ Rashleigh, *British Minerals*, i, p. 3; *Pl.* i, *Fig.* 3.

common in the neighbourhood, has been laid open, for, perhaps an acre in extent and to a depth of twenty feet or more. In the deepest parts several *(levels)* drifts have penetrated the *detritus;* but, for some time, operations have been discontinued.

West of the ridge which divides the southern from the northern drainage* both banks of a brook which rises in Tregurthy Moor,* south west of Castle-an-Dinas, and falls into the Bristol Channel at Porth in Saint Columb-minor, exhibit traces of ancient *stream-works;* but, within memory, one spot only has been wrought in the lower part of its course.

Some forty-five years ago many of my relatives† lived within a mile of the ancient entrenchment on Trevelguè-island;‡ and—whilst visiting them—I had frequent opportunity for examining the *stream-work,* then under active operation at Treloy§ in the immediate neighbourhood. Where—beneath the soil .

(1). Successive layers of sand and gravel alternate, to a depth of 8 or 10 feet;—
(2). Vegetable remains ..... succeed ,, 2 or 6 inches;—and
(3). The *Tin-ground,* which.. varies in thickness from 6 inches to 2 feet.

As every part of this deposit, wrought during memory of the generation now passing away, was beyond high-water-mark at Porth and even above level of the *raised-beach* at Fistral near Newquay,‖ it contained neither shell nor other substance of marine origin,¶ but frequently afforded granules of gold.••

The *Shelf* is of light blue and pale-buff-coloured, fissile, clay-slate.

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* *Ante,* p. 28.

* From this spot the earliest specimens of *wood-tin-ore* were obtained. PHILLIPS, *Mineralogy,* (3rd edition), p. 253. MICHELL, *Manual of Mineralogy,* p. 72.

† Lysons, *Cornwall,* p. 66. Hitchens and Drew, *History of Cornwall,* ii, p. 173. *Parochial History of Cornwall,* i, p. 242.

‡ Henwood, *Journal of the Royal Institution of Cornwall,* iii, (1869), p. x.

§ Henwood, *Cornwall Geol: Trans:* iv, p. 65. De la Beche, *Report,* p. 405.

‖ "North of the signal-station at Newquay is a bed of shelly sandstone "....and the same occurs in the cliffs around Fistral Bay, forming an exten- "sive horizontal bed which rests on the edges of the slate...The sandstone "of Fistral does not contain so large a portion of shells as that of Newquay; "and the lower part consists almost entirely of pebbles forming a kind of "conglomerate....These beds of pebbles and sand are situated just above "high-water-mark." BOASE, *Cornwall Geol: Trans:* iv, p. 259.

Paris, *Ibid,* i, p. 6. Pattison, *Ibid,* vii, p. 50. Tweedy, *Ibid,* p. 55. De la Beche, *Report,* p. 405. Sedgwick and Murchison, *Geol: Trans:* v, (N.S.) p. 284.

The *Ordnance Geological Map* (Sheet xxx,) indicates the remains of a Submarine forest near the outlet at Porth.

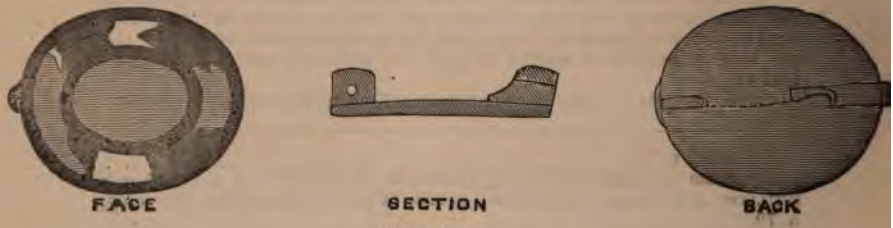
¶ De la Beche, *Report,* p. 405.

•• "The *stream-tin* obtained at Treloy was frequently mixed with grains "of gold; mostly about the size of wheat, but sometimes as large as pease." MR. JOHN NICHOLLS, Proprietor of Treloy, MS.

In a part of Treloy which bore no trace of previous operations at the surface, it was found that workmen of an earlier period had already examined the *tin-ground*. From amongst the refuse of their labours the hereinafter mentioned objects were obtained.

The *Fibula* (*Fig.* 4,)—now in the Museum at Truro—was imbedded, amongst previously moved sand and gravel, somewhat above the level of the *tin-ground* which had been already wrought; and was bought of the finder, (a workman on the spot), on the day it was found. It is of bronze, inlaid with a narrow oval (? of porcelain) disposed in symmetrical breadths, alternately of blue and white.

Fig. 4. Inlaid Fibula of Bronze. From Treloy, Saint Columb-minor. Discovered amongst sand and gravel which had been previously moved. *Presented to the* Royal Institution of Cornwall *by W. J. Henwood.* From a Drawing by Mr. H. M. Whitley, C.E.



Full Size.

The pan and cover (*Fig.* 5.) were discovered within a few yards of the *Fibula;* in a part of the *tin-ground* which bore evident proof of having been previously examined, notwithstanding it was overlaid by several thin, undisturbed, beds of sand and gravel.

Rims of perhaps twice the ordinary thickness of the vessel and its cover surround the edges of both; and both are thinly encrusted with earthy matter of leaden hue; the metal having, possibly, become reoxidized,* like the *Jew's-house-tin* of Kea and

* Michell, (J.), *Manual of Mineralogy*, p. 74. Collins, *Journal of the Royal Institution of Cornwall*, iv, (1872), No. xiii, p. 83. *Ante*, p. 206, *Note* †.

Tremethick, only in a smaller degree. These remarkable articles —together with some *Stream-tin-ore* from the same place—were taken to Trethellan-house for sale; and, as assay showed them to be of the purest metal, both were bought for conversion into some

Fig. 5. Tin Pan and Cover. From Treloy, Saint Columb-minor. Discovered in Tin-ground which had been previously wrought. *Presented to the* Royal Geological Society of Cornwall *by H. S. Boase, M.D., F.R.S., F.G.S.*, of Dundee. Drawn by Mr. H. M. Geoffroi.

Diameter 14 inches. Depth 4·75 inches. Thickness 0·12 inch.

saleable shape. Happily, however, Dr. H. S. Boase,—then a Partner in the Smelting Company—was present at the moment, and preserved them from destruction.

Between Lanherne and Mawgan Porth several alternations of mud, sand, and gravel, here and there mixed with large stones, overlie a mingled mass of branches, leaves, nuts, and other vegetable remains, which rests on a thin bed of poor *tin-ground.**

Early in the fourteenth century more than two-thirds of the

* Mr. William Leddicote, Superintendent of the works, MS.

tin-ore obtained in Cornwall was from this district;* and, probably the greater part was detrital. Three hundred years later the returns from East Cornwall had dwindled to less than one-sixth of their previous amount; and at present they are comparatively

* The following columns show the quantities of tin on which duties were paid to the Duchy of Cornwall, at the several Coinage towns, during different periods:—

PERIODS.

Towns.	1305—1306. Total. One year.	1577—1607. Average of forty years.	1837—1838. Total. One year.
Calstock	....	....	73·7 tons, Avoir.
Bodmin	74·3 tons, Avoir:	....	....
Liskeard	....	22·3 tons, Avoir.	....
Lostwithiel	201· ,, ,,	38·1 ,, ,,	....
Saint Austell	....	....	....
Truro	68·7 ,, ,,	167·1 ,, ,,	1,930·7 ,, ,,
Toynu [? Truro]	36·3 ,, ,,	....	....
Helston	6·1 ,, ,,	193·3 ,, ,,	....
Hayle	....	....	1,022·2 ,, ,,
Penzance	....	....	2,329·3 ,, ,,
Total	386·4 ,, ,,	.....	5,355·9 ,, ,,
Average	....	420·8 ,, ,,	....

The Coinages were held at the several privileged places during the undermentioned times; viz:—

Towns.	16th Nov., 1305—21st Sept., 1306.	1687—1835.	1835—1838.
Calstock	....	....	8
Bodmin	4	....	....
Liskeard	....	8	....
Lostwithiel	22	24	....
Saint Austell for Charlestown and Pentuan	....	....	16
Truro	4	48	48
Toynu [? Truro]	2	....	....
Helston	1	8	16
Hayle	....	....	24
Penzance	....	8 24 From 1753,	48

A Coinage being thus eventually established at every port in the tin districts.

insignificant. Many mines have been wrought within its circuit;

MACLEAN, *Journal of the Royal Institution of Cornwall*, iii, (No. xii), p. 238; iv, (No. xv), p. 187. HENWOOD, *Coinage Lists* 1835—1838.

For several years before the Coinages were rearranged (in 1835) Officers attended at the Prince's Halls, in Truro, Helston, and Penzance, during two days each in the first and second months of every quarter; on every *(piece)* block of tin, coined at such times, however, a fee of one shilling was paid by the smelter.

In 1305—6	the (*pieces*) blocks varied from	86 to 242,	and averaged about 120 lbs. (Avoir.) in weight;		
From 1577 to 1607.	,, ,,	308 ,, 346,	,,	,,	328 ,,
During 1837—8,	,, ,,	390 ,, 450,	,,	,,	420 ,,

From the foregoing particulars it may be presumed, that the *(pieces)* blocks of tin were conveyed to the Coinage-halls—

in .... 1305— 1306 .... mostly on beasts of burthen;—
from 1577 to 1607 .... ,, in carts;—
during 1837 — 1838 .... in carts and waggons only;—

and thus we may, perhaps, obtain some idea of the roads at different times.

Between the coast and the interior of Brazil all traffic is, even now, conveyed by mules; which travel from (3 to 4 leagues) 12 to 16 miles per day, carrying for many weeks in succession—loads of between (10 and 12 *arrobas*) 320 and 380 lbs. each.

"It hapned, that certaine Gentlemen, being Lords of seuen tithings in "Blackmoore...grew desirous to" [rework the mines]; "and so vpon suit "made to *Edmond* Earle of *Cornwal*, sonne to *Richard* king of the *Romans*, "they obtayned from him a Charter, with sundrie Priuileges,...in consider- "ation whereof, the sayd Lords accorded to pay the Earle a halfpeny for "euery pound of Tynne which should be wrought, and that for better "answering this taxe, the sayd Tynne should bee brought to certayne places "purposely appointed, and there peized, coyned, and kept until the Earle's "due were satisfied." CAREW, *Survey of Cornwall*, f. 16.

Until the reign of James I, the same rate—or; speaking more accurately, the rate of four shillings Stg. for one hundred Pounds *Avoir.*—was maintained (MACLEAN, *Journal of the Royal Institution of Cornwall*, iv, (1873), p. 188); but from (1686) the time of James II.,(a) *Merchant's* was contradistinguished from *Stannary* (presumably one hundred and twenty lbs. Avoir., to the hundred-) weight. (PEARCE, *Laws and Customs of the Stannaries*, p. 66).

Meanwhile the Duties in Devon were levied at the rate of one shilling and sixpence three farthings per one hundred and twelve (*Avoir.*) lbs.

It may not be difficult to offer a probable conjecture regarding the different rates of Duty levied in the two Counties. "In 1314—1315 the

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(a.) On the 12th of June 1688 [two days after the birth of the Prince of Wales, and three days after the seven Bishops had been imprisoned] John Lord Bellasis, and other Commissioners of the Treasury, on behalf of King James II, granted to John Earl of Bath, Lord Warden of the Stannaries, and others his partners "the sole Privilege of making Pence, "Half-pence and Farthings of Tin, to pass throughout all his Majesty's Dominions, free of "all Customs and other Duties whatsoever...."

PEARCE, *Laws and Customs of the Stannaries*, p. 91.

but, on the whole, they have failed to realize expectations founded on so rich a deposit at the surface.

"people of Cornwall complain...that Antonyn de Pisane and his merchants, "to whom the king (Edward II.) had granted pre-emption of tin in Cornwall "...weighed it with unlawful weights, and gave no more than forty two "shillings per thousand weight for the tin which they sold for six marks "(Four Pounds Stg.); and that the number of working tinners in Cornwall "was consequently reduced from 3000 to 500." SMIRKE, *Case of Vice against Thomas*, p. 18.

From 1291 to 1302 "the number of white tinners, *i.e.*, of persons em ployed in Devonshire in smelting tin, &c., and of black tinners employed in mining and producing black tin" (tin-ore)—

White-tinners.	*Black tinners.*
varied from 86 to 302, and averaged 180;	varied from 199 to 473, and averaged 370. *Ibid*, p. 44.

"The times of Coynage come twise in the yeere, *viz.*, about Midsummer "and Michalmas; but because it falleth out verie often, that the Tynne "which is wrought, cannot be blowen and brought thither against the limited "dayes, there are, in favor of the Tynners, certaine later times assigned, "which they term Post-coynages." CAREW, *Survey of Cornwall*, f. 13.

"For the indulgence of Coining at Christmas and Lady-day the owners "pay four pence per hundred on stamping, or what is called *post-groats*, "which are generally farmed out every thirty-one years." GILBERT, (C. S.), *Historical Survey of Cornwall*, i, p. 245.

The *post-groats* were farmed by descendants of a former Surveyor-General of the Duchy until 1838, when—like the other imposts—they were abolished by Parliament.

Moreover, at every Coinage, other—though smaller—charges, known as *Fees* and *Great-pieces*, were also made. Of these the last, at least, was probably of very early origin, for "*the account of Thomas de Ocham, receiver, "during the shrievalty of Thomas de la Hide, steward and sheriff of Cornwall, "in the time of Earl Edmund*, 25 Ed. I [A.D. 1296—1297,]" mentions "in "240 grossis peciis removendis de aula in curiam, 5s." SMIRKE, *Case of Vice against Thomas*, p. 45.

The Assay was made—as usual in Smelting-houses—by cutting partly and then breaking off a small piece from a lower corner of each block; the toughness and the fracture sufficiently indicating the quality. By prescriptive right the Assay-Master claimed the severed portions as his perquisite; but they were always returned to the Tinner on payment of four pence a *(Coin)* piece to the officer; who, in fact, received no other remuneration, until the Coinages were rearranged in 1835; but from that time forward he, like the other officers, was paid a fixed salary from the Duchy.

Each *(piece)* block of tin assayed and weighed at the Coinage was imprinted with "the Duchy arms, viz., argent, a lion rampant, gules, "crowned or, within a border sable, garnished with bezants, which arms "were first used by Richard, King of the Romans, and Earl of Cornwall." GILBERT, (C. S.), *Historical Survey of Cornwall*, i, p. 246.

When the Duties and other charges on the Coinage of tin were abolished by Parliament in 1838, the Duchy was compensated with an annuity calculated on the income of ten immediately previous years which averaged £16,216. 5s. 1½d.

Gold has been found mixed with *stream-tin-ore* in Kenwyn,*† Ladock,‡ Probus,* Creed,* Saint Ewe,* Saint Mewan,* Gorran,§ Saint Stephen's, Saint Austell,‖¶** Lanlivery,†† and Lostwithiel;‡‡ but the entire produce of the County can scarcely have exceeded a few lbs. As, however, no single mass, yet discovered, has weighed an ounce,§§ as the specimens have rarely exceeded a penny-weight, as many weigh but a few grains each, and as still greater numbers are even smaller, there may be ground for suspicion that no considerable extent of *tin-ground* is absolutely destitute of gold,‖‖ but that much has escaped notice from the smallness of the particles and the inexperience of the workmen.

Masses of *Jew's-house tin*¶¶ have been discovered in several

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* Borlase, *Natural History*, p. 214.

† Michell, *Manual of Mineralogy*, p. 2.

‡ Hawkins (Sir Christopher), *Cornwall Geol: Trans*: i, p. 235.

§ Captain James Knight, Superintendent of the *Stream-work*, MS.

‖ Klaproth, *Mineralogical Observations*, p. 12.

¶ Petherick (W.) and Martin, *Journal of the Royal Institution of Cornwall*, iii (No. xi.) p. xiii.

** Forbes (David), *London, Edinburgh, and Dublin Phil: Mag*: xxxvii, (1869), 323.

†† *Ante*, p. 27, 28.

‡‡ Borlase, *Journal of the Royal Institution of Cornwall*, i, (No. iv.) Supplement, p. 35.

§§ "The largest piece [of gold] found in Cornwall...is that in the possession of William Lemon, Esq., of Carclew, which weighs in gold-coin three pounds and three shillings, or fifteen pennyweights and sixteen grains...It appears to have come from a vein half an inch wide at a medium. On each side it has a light-brown, fatty earth, which is the only impurity it is mixed with. It was found in the parish of Creed, near the borough of Granpont." BORLASE, *Natural History*, p. 214.

‖‖ "Mr. Rosewarne [one of the principal tin-smelters in Cornwall] suspects, as he informs me, that there is gold, more or less, in all stream-tin in the County." *Ibid*, p. 214.

¶¶ "In the stream-works in St. Stephen's Branel, they find now and then some small lumps of melted tin, two inches square and under:...this kind cuts with difficulty, and more harsh and gritty than the common melted tin...These fragments I look upon as fragments...scattered from the Jewish melting-houses." BORLASE, *Natural History*, p. 163.

"In May 1765 was found near St. Austle by some streamers, a large cake of Tin-ore, weighing about six pounds, irregular in shape,...lying about 5 feet under the surface, and in the middle of that Stratum of Tin-ore so remarkably spread in the Moor adjoining to the forementiond'd town.

parts of the district; but most frequently, though not always,* towards its southern boundary; there is, however, reason to believe that such discoveries have been of late much less numerous

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"When the lump was broke it appeared to consist of two incrustations sur-
"rounding the whole, and a Nucleus or central substance of crystal intermixed
"with the purest malleable tin. The outmost crust was about the 8th of an
"inch thick at a medium, and of a brownish straw-colour; the 2nd incrustation
"was more blackish in colour, closer grain'd with some faintish appearances
"of whitish specks interspersed, about one third of an inch thick; these
"two incrustations...inclosed a third substance, consisting of laminated crys-
"tals, rising side by side out of an edging shining like melted tin, which
"lies as it were at their roots coherent to the 2nd incrustation; the Laminæ
"of crystal...being shot in a great variety of directions intersect each other,
"and leave a vast number of cells, within which are plainly seen, and may
"be freely cut with a knife, many specks and granules of perfect native tin."
BORLASE, *Journal of the Royal Institution of Cornwall*, i, (No. iv.) Supplement, p. 25.

"On...the 27th of July '65 was found in a Stream-work near the borough
"of Granpont,...another lump of the same kind of Tin-ore as the former,
"as to its crust and covering; its weight was between eleven and twelve
"pounds; the pure tin was not in granules as in y^e^ first Specimen, nor thin
"as a leaf as in No. 2, but much more abundant, and in some places more
"than one inch thick; the Metal was inclos'd so securely, that but for the
"extraordinary weight it had pass'd unnotic'd....but whether Native, or
"Tin melted by Art and inclosed by long lying in a petrifying Tin-water with
"a Crust similar to that of the forementiond Specimen, I can't affirm."
Ibid, p. 26.

Some few years ago a mass of *Jew's-house* tin, which weighed seventy five pounds, was discovered at Burngullow in St. Mewan. Its shape was rather oval, and it measured—

20. inches in length;—
11. ,, width;—
and at the middle 2·5 ,, extreme thickness; thinning, however,—almost to an edge—at the sides and ends. The discoverers took it to, and sold it at, Calenick Smelting-house near Truro, and there it still remains. MR. FRANCIS MICHELL, of Calenick, MSS.

A mass, in which small, rich, pebbles of *stream-tin-ore* and fragments of charcoal were cemented by metallic tin, was discovered, immediately below the surface, in Trethowel-wood near St. Austell. Occasional interstices between the other ingredients, were sometimes thinly encrusted with light-lemon coloured granules. Its weight was eighty pounds; and—about three years ago—it was sold to the Carvedras Smelting Company (at a rate of £95 per ton,) for £3. 6s. 5d. This remarkable specimen now enriches the collection of Mr. J. C. Daubuz of Killiow near Truro. MR. WILLIAM PETHERICK, of Saint Austell, MSS.

* "A slab of *Jew's-house-(grain)-tin*...weighing 39½ lbs. avoirdupois
"...was found on the Barton of Carnanton, Parish of Mawgan in Pydar,
"two feet and a half under the surface, in swampy ground, and contiguous
"to what is usually called a Jew's House." MICHELL (JOHN), *Manual of Mineralogy*, p. 75. POOLE, *Journal of the Royal Institution of Cornwall*, i, (No. iv.), p. 9.

than they were formerly, and that the specimens have found their way to the Smelting-house more frequently than to the Museum.

Whether the more carefully moulded blocks disinterred from the sand, gravel, and shingle of St. Austell moor,* and dredged from the bottom of Falmouth harbour,† are to be classed with more rudely shaped,—and perhaps more deeply oxidized‡—masses seems an Antiquarian, rather than a Geological, enquiry.

In the *stream-works* of St. Austell and Lanlivery..about 25,—and
„ „ the Tregoss-moors ..... „ 10
men and boys now (1873) find employment.

"About [the year 1772] a slab of tin weighing about 20 lbs., was found "in the Goss-moors in Roche, which from its appearance seemed to be very "ancient. It was found, about four feet below the surface, by some tinners "who were searching for ore. It was about three inches thick and its width "and length were in proportion. In colour it bore a strong resemblance to "lead; but on examination it was found to be very deficient in purity, its real "metal when separated from the dross not amounting to more than 13 lbs. "A singular kind of ancient shovel was also found at the same time and "place." HITCHINS AND DREW, *History of Cornwall*, ii, p. 587.

"In the parish of Withiel there exists the remains of a Jew's-House— "to use its popular designation—formerly used [for smelting tin-ore] on a "farm called Landjew." *Gentleman's Magazine*, xcvi, (1826), p. 125.

* "In one of the [stream-works on the St. Austel moor] were lately "found, about eight feet under the surface, two slabs, or small blocks of "melted tin, of about twenty-eight pounds each, of a shape very different "from that which for many years has obtained in Cornwall...They have "semicircular handles or loops to them, as if to sling and carry them more "conveniently on horseback; they are much corroded by the sharp waters "in which they have layn, a kind of rust or scurf-like incrustation enclosing "the tin." BORLASE, *Natural History*, p. 163, *Pl.* xx, *Fig.* 19.

† "The form of the block of tin which was dredged up in Falmouth "harbour....about forty years ago and presented by the late Thomas Daniell, "Esq., of Truro, to the Museum of the *Royal Institution of Cornwall*....is "that of an *astragalus*, or knuckle-bone...It is 2 feet 11 inches long, 11 "inches wide, and 3 inches thick at the centre, perfectly flat on one side, "but curved on the other, and having four prolongations at the corners, "each 1 foot long. It is said by Diodorus that the inhabitants of Belerium "(the most western part of Cornwall) cast the tin into the form of '*astragali*.' "....The weight, about 130 lbs., is just the proper weight for a horse having "to carry two of them on a pack-saddle." JAMES, *Report of the Royal Institution of Cornwall*, xlv (1862), pp. 29, 32, 33, *Pl.* iii.

"The block in the form of an *astragalus*, found near St. Mawes, at the "entrance to Falmouth harbour, marked with a symbol, a small *astragalus* "....weighs 158 lbs. avoirdupois." POOLE, *Journal of the Royal Institution of Cornwall*, i, (No. iv), p. 9.

‡ Michell, (J.), *Manual of Mineralogy*, p. 74. Collins, *Journal of the Royal Institution of Cornwall*, iii, (No. xiii), p. 84. Napier, *Ibid*, p. 84. Percy, (Dr., F.R.S.), MS.

The eastern district is bounded by the Fowey and the Camel and certain of their tributaries on one side, and by Devonshire on the other. It comprehends the great granitic range—the most elevated part of Cornwall*—which extends from the vicinity of Cardinham-bury on the south-west beyond Brea in Alternun on the north-east, and from Greylake near Camelford on the north-west to Stanton in Saint Cleer on the south-east,† beside smaller bodies of similar character at Kit-Hill,* and at Gunnis Lake on the Tamar;†—slate—possibly of more than one period‡—usually mantles round the granite, of which, however, veins and beds§ either intersect or—less frequently—interlie the planes of cleavage; but in one instance at least a considerable tract of slate—probably of no great thickness‖—is entirely surrounded by granite;—felspathic and quartzose porphyries *(elvans)* form broad

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* Kit Hill rises ..... 1,067 feet above the sea;—
Caradon ..... 1,208 ,, ,, ;—
Kilmar ..... 1,277 ,, ,, ;—
Rough Tor ..... 1,296 ,, ,, ;—
Brown Willy ..... 1,368 ,, ,, .

Maclauchlan, (De la Beche's) *Survey*, pp. 14, 17, 18.

† Boase, *Cornwall Geol*: *Trans*: iv, pp. 173, 210, 221. De la Beche, *Report*, pp. 159, 161. Sedgwick and Murchison, *Geol*: *Trans*: v, p. 685. Whitley, *Report of the Royal Institution of Cornwall*, xxxii, (1850), p. 31. Holl, *Quarterly Journal of the Geological Society*, xxiv, p. 440. Henwood, *Cornwall Geol*: *Trans*: v, p. 131; viii, pp. 655-660.

‡ Berger, *Geol*: *Trans*: i, p. 123. Mohs, *Thomson's Annals of Philosophy*, xiii, p. 311. Conybeare, (J. J.), *Geol*: *Trans*: iv, p. 424; *Annals of Philosophy*, (N.S.), iv, p. 401; v, p. 185; vi, p. 37. Boase, *Cornwall Geol*: *Trans*: iv, pp. 382-398. De la Beche, *Report*, pp. 56-58, 61-63, 79-81. Phillips, (Prof.), *Palæozoic Fossils of Cornwall, Devon and West Somerset*, pp. 164-182, 195-200. Sedgwick and Murchison, *Geol*: *Trans*: v, pp. 665, 668. Sedgwick, *Quarterly Journal of the Geological Society*, viii, p. 16. Henwood, *Cornwall Geol*: *Trans*: v, pp. 134-136; viii, pp. 667-673, 700-703. Holl, *Quarterly Journal of the Geol*: *Society*, xxiv, pp. 402-406, 414-426. Peach, *Cornwall Geol*: *Trans*: vi, pp. 12, 51, 181, 236, 296; vii, pp. 17, 57, 121, 125, 175. Williams, *Ibid*, vi, p. 122, 334; vii, p. 64. Couch, (J.), *Ibid*, vi, p. 139; vii, pp. 244, 249. Couch, (R. Q.), *Ibid*, vi, pp. 147, 219, 276; vii, pp. 13, 193, 273, 300, 317. Pattison, *Ibid*, vi, p. 267; vii, p. 1, 63, 109, 132, 208, 246. Murchison, *Ibid*, vi, p. 317. Giles, *Ibid*, vii, pp. 93, 155, 169. Pengelly, *Ibid*, vii, pp. 106, 115, 211, 388, 441. Whitley, *Ibid*, vii, p. 336, *Pl.* iv.

§ Webb and Geach, *History of Mining in the Caradon District*, p. 67. Henwood, *Cornwall Geol*: *Trans*: viii, pp. 656-660.

‖ *Ordnance Geological Map*, Sheet xxv. Whitley, *Geological Map of the Caradon Mining District*. Henwood, *Cornwall Geol*: *Trans*: viii, p. 657.

dykes *(courses)* which traverse both granite and slate,* and occur also in isolated masses, but these are peculiar to the granite;—and bodies of felspathic and hornblendic rocks sometimes sever, sometimes interstratify,† the slate.

The granite, slate, elvan, and hornblendic rocks are all traversed by the *lodes;* but on opposite sides of these the strata do not always occupy co-incident positions;‡ and the rocks as well as the *lodes* are traversed by *cross-veins.*§ The *lodes* which yield ores of tin and copper usually bear a few degrees north of east and south of west,‖ and the *cross-veins* (which are rarely productive at the intersections) range from north or north-west to south or south-east;¶ but where ores of lead and silver prevail the productive series usually takes a nearly meridianal direction,** whilst the unproductive veins cross them.†† Both *lodes* and *cross-veins,* generally speaking—though with many exceptional cases—dip towards the nearest body of granite.‡‡

Tin-ore occurs in *lodes* which traverse§§—

—the slate at Saint Neot, Saint Cleer, Linkinhorne, South Hill, and Calstock;—and

—the granite at Saint Cleer, Linkinhorne, Alternun, and South Hill.

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* Boase, *Cornwall Geol*: *Trans*: iv, p. 210. De la Beche, *Report*, pp. 180, 183. Giles, *Cornwall Geol*: *Trans*: vii, p. 201. Whitley, *Geological Map of the Caradon Mining District.* Holl, *Quarterly Journal of the Geological Society*, xxiv, pp. 415, 441. Henwood, *Cornwall Geol*: *Trans*: viii, p. 670.

† Rogers, (Canon), *Cornwall Geol*: *Trans*: ii, p. 218. Boase, *Ibid*, iv, pp. 208, 220. De la Beche, *Report*, p. 79. Holl, *Quarterly Journal of the Geological Society*, xxiv; pp. 421, 444. Giles, *Cornwall Geol*: *Trans*: vii, p. 205. Henwood, *Ibid*, viii, pp. 661, 701.

‡ Henwood, *Cornwall Geol: Trans*: viii, pp. 656-660.

§ *Ibid*, viii, pp. 685, 714.

‖ *Ibid*, viii, pp. 674, 704.

¶ *Ibid*, viii, pp. 681, 715.

** *Ibid*, viii, p. 704.

†† *Ibid*, viii, p. 715.

‡‡ *Ibid*, viii, p. 675, 682.

§§ Copper and many of its ores are found
in slate at Saint Neot, Saint Cleer, Linkinhorne, South Hill, and Calstock;—
in granite at Saint Cleer, Linkinhorne, and Calstock.
Lead-ore is associated with silver
in slate at Saint Pinnock, Menheniot, Saint Ive, South Hill, and Calstock.
Native silver, and several ores of silver have been obtained
in slate at Saint Pinnock, Saint Ive, and Calstock.

At *Lark-holes** near Redgate tin-ore is scattered in isolated masses, and at *Gonamena*† on the south-western slope of Caradon as well as at Kit Hill,‡ it is disseminated, through the granite.

Notwithstanding every part of the waste between Powne's-cost and Five-lanes has been furrowed in search of *stream*-tin-ore, the miner has found no encouragement there or in the neighbourhood§; for, at present the entire tract and the (Drains and the Saint Neot) tributaries of the Fowey—which rise in it—scarcely afford a livelihood to thirty workmen.

At *Netherton*, in Saint Neot, operations have been lately resumed on a—previously wrought yet unexhausted—spot, beside the Drains river. The present works have not yet reached the sides of the ancient opening; and the vegetable mould, the more recent granitic sand and gravel, the peat, and the small angular, subangular, and rounded masses of granite, as well as the ingredients associated with them, were all indiscriminately mixed by the earlier workmen; neither the works nor the matter extracted from them affords, therefore, available clue to the natural succession of the several deposits. The small quantity of *tin-ground* still remaining is covered by large blocks‖ of hard granite; and it cannot be extracted until they have been removed. The *Shelf*—everywhere more or less disintegrated—consists of rather coarse-grained granite; in which eroded pits—beneath hard, *travelled* rocks, especially,—contain quantities of rich *stream*-tin-ore.

At *Penny-snap, (Wheal Prosper)* in Alternun, a *stream-work*, immediately east of the Drains river, has laid open—

(1). Peat¶ .... 7 feet;—

(2). Angular, subangular, and rude spheroidal, masses of granite, schorl-rocks, and quartz; varying from the size of fine sand, to many inches in length, breadth, and thickness, all imbedded in pale blue felspathic clay; from 3 to 6 feet, and averaging about..... 5 „ ;—

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* Mr. John Taylor, Purser of *Craddock Moor*, MS.

† Henwood, *Cornwall Geol*: *Trans*: viii, p. 664.

‡ *Ibid*, v, p. 132.

§ The *Ordnance Geological Map* (Sheets xxv and xxx, coloured by Sir H. T. De la Beche in 1839) indicates no *lode*—though one at least has been since discovered—north of the, now nearly exhausted, deposit of *stream*-tin-ore long wrought on the Bodmin moors.

‖ Henwood, *Cornwall Geol: Trans:* iv, p. 61; *Ante*, p. 26.

¶ Of this, valuable fuel, little or no use is made in the neighbourhood.

(3). The *tin-ground* generally consists of much the same ingredients as the deposit (2) directly above it; but perhaps it may sometimes affect smaller and more rounded masses.* The tin-ore occurs, mostly, as water-worn sand or gravel; but now and then in perfect (unfractured) crystals ..... 3 „ ;—

The *Shelf* is rather coarse-grained granite; moderately hard whilst covered, but it rapidly disintegrates when—in progress of the work—it is exposed.

The pits are drained by aid of water-wheels; respectively—

6 feet in diameter, and 3 feet wide *(in breast)* at *Netherton;* and
7 „ „ „ 1·5 foot „ „ „ *Penny-snap.*

Trewint-Marsh, also in Alternun, drains into a brook which feeds the Lynher, a tributary of the Tamar. At and near its head, operations have been long discontinued; but an instructive section is still visible. The *tin-ground* was long since gleaned of any ore it might have contained; but the remaining portions of it, and the whole succeeding deposit—both, consisting of granite, schorl, quartz, and felspar, beside fragments of various granitic *vein-stones*—affect, here and there, rude spheroids, and, perhaps more frequently, subangular masses; but for the most part they are rough angular blocks, which bear no mark of attrition.

The moors west of Kilmar, Sharp Tor and the Cheese-wring decline towards Trewartha-marsh, whence their drainage falls into the Lynher. The bed and margin of every tributary† evidence the labours of earlier *streamers*, who sometimes found particles of gold mixed with their tin-ore.‡

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* "The stream-works in the valley of the Fowey, on the Bodmin moors "...show that twice has the surface been clothed with vegetation. The first "time, on a granitic soil, grew large timber trees: a flood laid them down... "with their heads directed down the valley...and spread a layer of granite "pebbles and tin over them: another soil was formed supporting a vegeta-"tion of bushes and ferns, the resort of the deer, and upon this a finer gravel, "the result of slower and longer diluvial action, accumulated: and lastly, "on this, a third bed of peat has arisen, crowned with no leafy honours, and "whose tallest plant is the low but elegant heath." PATTISON, *Cornwall Geol: Trans*: vii, p. 36.

† Blight, *Journal of the Royal Institution of Cornwall*, iii, (No. ix,) p. 13.

‡ Three-quarters of an ounce of gold culled from amongst the *stream*-tin-ore of his domain in North Hill, was—by direction of Mr. Spoure (who died in 1696)—made into a signet-ring, which has descended, as an heir-loom, to his representative Mr. Rodd of Trebartha, whose muniments comprise a contemporary manuscript descriptive of the conditions under which both the metal and the ore were discovered. MR. EDWARD HEARLE RODD, of Penzance, MS.

As the earlier accounts show that tin was obtained in this district and in its neighbourhood in much larger quantities than in any other part of Cornwall,* it might have been expected that traces of works still more ancient would have been more numerous, and masses of *Jew's-house-tin* more frequently found. If it were so, however, they probably found their way to the Smelting-furnace at once; for the interest of Antiquaries and Mineralogists in their preservation was, at that time, but slightly aroused. As, for many years past, *tin-streaming* has had but a bare existence in the vicinity, neither specimen, nor record of discovery,† has rewarded later enquirers.

"The present Mr. Glynne of Glynne has...shown me a large gold "Seal-ring made of Gold hoppes found in the River under his house" [Mr. Tonkin's papers MS. B: pa: 54]. "I have also Two small pieces found in a "Stream-work near the Church of Cardynham not far from Bodman." BORLASE (Additions to *Natural History*), *Journal of the Royal Institution of Cornwall*, I. (No. iv.) Supplement, p. 35.

"In a *stream-work* conducted by me on the river Camel a good bit of "gold was found mixed with the tin-ore." CAPTAIN JAMES KNIGHT, MS.

* Maclean, *Journal of the Royal Institution of Cornwall*, iii, p. 238.

† At Berriow in North Hill the ruins of an old building—always known as *the Jew's-house*—were removed about 1832-3, and beneath them were found—

a ladle of stone [? potstone] now in the Museum of the ROYAL INSTITUTION OF CORNWALL; and two troughs or moulds of granite, which measured respectively—

	The smaller.		*The Larger.*	
Length	Top	16· inches	.....	24 inches.
,,	.....Bottom ...	12· ,,	.....	18 ,,
Width	.....Top	11· ,,	.....	14 ,,
,,	.....Bottom	7·5 ,,	.....	9 ,,
Depth	.....	5· ,,	.....	7 ,,

Their capacities, therefore, were about } 647·5 cubic inches..... 1690 cubic inches;

and masses of tin of these respective dimensions would have weighed some } 173lbs. Avoir. ..... 445lbs. Avoir. each.

That is to say one would have been an ample *half-load* for a packhorse on a short journey;—

,, the other ,, about the weight of the heaviest blocks of tin *coined* in 1837—8.

Neither ore, fuel, slag, nor metallic tin, was found amongst the rubbish.

RODD (F.) *Report of the Royal Institution of Cornwall*, xxxii (1850), p. 58. Abridged.

The following pages—enumerate various relations between detrital repositories of tin-ore and the water-shed of Cornwall;—show the respects in which their mineral characters either resemble or differ from, those of the *(Shelf)* rocks on which they rest, and of other strata in their several neighbourhoods;—point out the mechanical conditions of the *tin-ground* in different districts;—describe the numerous deposits between the metalliferous beds and the surface;—recapitulate their organic contents;—and mention the unequal elevations at which tin-bearing detritus has been scattered.

(I). *The water-shed of Cornwall* presents several remarkable flexures;* but—except in two instances, one of small, and other of not very considerable, extent—its range is much nearer to the north, than to the south, coast. As the velocity of streams must be proportional to the inclination of their beds, those which have the same fall within the shortest distance, must—under ordinary circumstances—flow most rapidly; whilst those which receive the drainage of the widest areas, must—under like conditions—attain the largest volumes. The small, short, shallow, and comparatively rapid brooks which fall directly into the Bristol Channel, thus possess proportionally greater degrading and transporting powers, than the longer, larger, and slower streams which flow into the English Channel. The former, therefore, deposit, on their beds and banks, very little of the disintegrated matter, which they hold in suspension; but on reaching the sea-level, and there meeting the tide, their velocity is arrested, the solids subside, and form—at the mouths of the several estuaries—sand-banks and shoals which—as at Hayle, Padstow, and intermediate creeks of less importance—materially obstruct the navigation. The Camel—the longest of our northern rivers—can scarcely be included in this category; for its direction is neither directly transverse, nor accurately parallel, to the water shed; but numerous important tributaries—flowing directly from the central range—materially modify its character. The streams which issue from the southern slope have, generally speaking, a longer and, con-

* De la Beche, *Report*, p. 19, *Fig.* 1. *Ante*, pp. 3, 5, 7, 8, 9, 11, 14, 22, 23, 25, 27, 28, 31, 40, 42, 43.

sequently, a less rapid course; and—as they receive the drainage of wider tracts—their volume is proportionally larger. In steeper parts of their progress, and where they traverse rocks in some state of disintegration, however, they erode and carry with them certain portions of the *débris;* but, where the declivity diminishes, the velocity—and with it the suspending power—of the current declines; and some, at least, of the suspended matter subsides* to the bottom or on the margin of the streams. Where the rivers fall into broad gulphs—as at the Mount's-bay and the bay of Tywardreath, or into deep inlets—as at Falmouth and Fowey, —their mouths are rarely obstructed by shallows. But the bars of sand, which to a greater or smaller extent—obstruct the entrances to all our northern creeks,† can scarcely be said to have assumed their normal forms, if, indeed, their actual positions, under action of the sea alone; for they are barely uncovered, by the ebbing tide, before the finer particles begin to drift, under the influence of even an ordinary breeze.‡ During heavy gales‡ the sands rise in clouds, and—driven far inland—irreclaimably overwhelm large tracts of country;§ of late years however, such

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* Thomas, (R.), *History of Falmouth*, p. 46.

† Borlase, *Natural History*, pp. 44-47. De Luc, *Geological Travels*, iii, pp. 178, 181, 182-3. Paris, *Cornwall Geol: Trans:* i, p.4. Boase, *Ibid*, iv, p. 260. De la Beche, *Report*, pp. 425-428. Sedgwick and Murchison, *Geol: Trans:* v, (N.S.), p. 285.

‡ "Saint Peran...too well brooketh his surname, in Sabulo: for the "light sand, carried up by the north wind, from the sea shore, daily con- "tinueth his covering, and marring the land adjoynant...draue the Inhab- "itants to remooue their Church." Carew, *Survey of Cornwall*, f. 148.

"My father has informed me that within seventy or eighty years, a field "in preparation for tillage, by some of his relatives, in Perran-zabuloe, was, "during a storm, irreclaimably covered in a single night with sand, which "had drifted to the depth of a foot." Henwood, *Cornwall Geol: Trans:* v, p. 112, Note †.

§ Daily observations on the winds which prevailed at Penzance during twenty-one years (1807-1827) show their annual average directions to have been—

N.	50 days.	S.	41 days.
N.E.	72 ,,	S.W.	117 ,,
E.	45 ,,	W.	123 ,,
S.E.	57 ,,	N.W.	146 ,,

Giddy, (E. C.), *Phil: Mag: and Annals*, iii, (1828), p. 179.

disastrous consequences have been materially arrested, by planting the sand-hills with the sea-rush, *(Arundo arenaria.)**

(II). *The mineral characters of the tin-ground,—of the (Shelf) rock, on which it rests,— and of the strata adjoining the Shelf,* in various parts of Cornwall, are compared in *Table I.*

(*a*). *The earthy portions of the tin-ground.* It seems that where —as in the moors of Towednack,† Wendron,‡ Saint Austell,§ Luxulion,‖ and Alternun¶—the *tin-ground* lies far within the boundary of its native series, the earthy ingredients of the one so closely resemble the general characters of the other as to forbid absolute identification of the rocks and veins from which the *detritus* had been reft. Even where the *tin-ground* occurs near the junctions of different systems—as in the swamps of Saint Austell,§ Luxulion,‖ and Saint Columb-major,**—the *débris* of the stratum immediately beneath always prevails; sometimes, indeed, to, all but, an entire exclusion of the other.†† Generally speaking, however, the fragments are intimately mixed; but, perhaps, not always in the same proportions. This, however, is not always the case; for at Carnon the upper and the lower parts sometimes differ in mineral character.‡‡

(*b*). *The metallic ingredients of the tin-ground* comprehend several of the more plentiful ores; viz:—blende,§§ copper in the

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* Paris, *Guide to the Mount's-bay*, p. 162. Henwood, *Cornwall Geol: Trans:* v, p. 113.

† *Ante*, p. 6.

‡ *Ante*, pp. 10-11.

§ *Ante*, pp. 25-26.

‖ *Ante*, pp. 27-28.

¶ *Ante*, p. 42.

** *Ante*, pp. 29-30.

†† "Le gîte exploitable près Pentovan...renferme des fragmens plus ou "moins volumineux...de toutes les roches et de toutes les gangues qui se "trouvent dans la contrée environnante, mais cependant à l'exception du "granite." Heron de Villefosse, *Richesse Minérale*, ii, p. 354.

‡‡ "The bottom [of the *tin-ground*] has sometimes a different quality "of waste associated with it as if deposited at a different period." Taylor, (C. Dyke), *Proceedings of the Institution of Mechanical Engineers*, (Cornwall Meeting), p. 161.

§§ Henwood, *Cornwall Geol*: *Trans*: iv, p 66.

state of pyrites* only, and more than one compound of iron;† but all in much smaller quantities and less frequently than in the *lodes*. Indeed the proportion of tin-ore in the *tin*-ground of one of the largest and richest stream-works in Cornwall‡ scarcely exceeded that contained in vein-stones of the very poorest *lodes* when culled and made ready for the stamping-mill.§ Whether substances with which the tin-ore was associated in the *lodes* were separated from it whilst passing from its original, to its latest, repositories, or that the lighter and more soluble impurities were afterwards removed, in suspension or solution, by the streams, of spring and rain water, percolating through the *tin-ground*, is scarcely within compass of this enquiry;‖ but that the *(grain-tin)* metal obtained from *stream*-ore is of better quality than the metal afforded by mine-ore has been long and generally known.¶

(*b*–1). *Gold has been culled from amongst the detritus of every tin-producing district in Cornwall; viz:*—at Saint Just,** Wendron,††

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* Colenso, *Ibid*, p. 31.

"Native copper is frequently found in our mines, near the surface, or "commonly but a few fathoms deep." PRYCE, *Mineralogia Cornubiensis*, p. 61.

† Colenso, *Cornwall Geol*: *Trans*: iv, p. 31. Henwood, *Ibid*, p. 59.

‡ "The quantity of tin-ground opened at Pentuan has been seven "hundred fathoms in length, averaging about twenty six fathoms in breadth, "making a total of eighteen thousand two hundred square fathoms. The "average quantity of black-tin [ore] gotten per square fathom has been one "hundred and eighty pounds" [or about 0·00500 its weight.] COLENSO, *Cornwall Geol*: *Trans*: iv, p. 32, Note.

In Banca "the quantity [of ground] worked over per man yearly, on an "average from 10,000 to 16,000 cubic feet, must contain 19 to 20 cwt. [from "0·00076 to 0·00128 its weight] of tin-ore." VAN DIEST, *Banca and its Tin Stream-works*, (Translated by CLEMENT LE NEVE FOSTER, B.A., D.S., F.G.S.) p. 84.

§ *Quarterly Journal of Science*, iii, (1866,) p. 108. Henwood, *Cornwall Geol*: *Trans*: viii, p. 472.

The proportion of tin-ore obtained from the *tin-ground* at Carnon varies from 0·150 to 0·001 the weight of the mass. TAYLOR, (C. DYKE), *Proceedings of the Institution of Mechanical Engineers*, (Cornwall Meeting), p. 161.

‖ "The metalliferous substances obtained from washings, are such as "are not liable to undergo decomposition when exposed to air and moisture." WHITNEY, *Metallic Wealth of the United States*, p. 200.

¶ Carne, *Cornwall Geol*: *Trans*: ii, p. 332. Henwood, *Ibid*, iv, p. 65.

** Carne, *Cornwall Geol*: *Trans*: ii, pp. 293, 300.

†† Henwood, *Ante*, p. 13, Note‡.

Perran-ar-worthal,* Feock,† Kenwyn,† Ladock,‡ Probus,§ Creed,§ Gorran,‖ Saint Ewe,¶ Saint Austell,** Saint Stephens, Luxulion,†† Lostwithiel,‡‡ Saint Columb-minor,§§ Cardinham,‖‖ and North Hill;¶¶ but so sparingly that it bears no assignable proportion to the other ingredients.

Of the specimens hitherto discovered, the fragments of one amounted to an ounce*** *(Troy)*, another has weighed nearly (0·7 oz.) sixteen,††† a third (0·6 oz.) more than eleven*** penny weights, and many other have been as large as pease. Much of the gold has occurred in small—and sometimes rounded—*nuggets*, thin flakes, and slender threads; but the greater part is in crystalline granules‡‡‡ and in dust.*** Detrital gold is, in quality, as superior

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* Francis, (W.), *Gwennap; a Descriptive Poem*, p. 94. *Ante*, p. 17.

† Michell, (J.), *Manual of Mineralogy*, p. 2. Henwood, *Cornwall Geol: Trans*: iv, p. 66. *Ante*, p. 17.

‡ Hawkins, (Sir C.), *Cornwall Geol*: *Trans*: i, p. 235.

§ Borlase, *Natural History*, p. 214. *Ante* p. 37.

‖ Captain James Knight, of Menadue in Luxulion, MS.

¶ Borlase, *Natural History*, p. 214; *Journal of the Royal Institution of Cornwall* i, (No iv), Supplement, p. 35.

** "Stream-tin from Pensagillis is remarkable on account of the native gold, which now and then is met with in it, and found, though very rare, in pieces of the value of two or three pounds sterling." KLAPROTH, *Mineralogical Observations*, p. 12.

Petherick and Martyn, *London, Edin*: *and Dublin Phil*: *Mag*: xxxv, (1869), p. 323.

†† Maton, *Observations on the Western Counties*, i, p. 175. Henwood, *Ante*, p. 27.

‡‡ "In the Bayliff of Blackmoor, a M.S. in my possession, written by "one Mr. Beare, in Queen Elizabeth's time, there is an account of a Gentle-"man who at a wash of tin at Castle Park near Lostwithiel, took up out of "the heap of tin certain fine corns, *hops*, or grains of Gold which they "call Rux." PRYCE, *Mineralogia Cornubiensis*, p. 52.

§§ Mr. John Nicholls, of Trekenning, Saint Columb, MS.; *Ante*, p. 32.

‖‖ Borlase, *Journal of the Royal Institution of Cornwall*, i, (No. iv), Supplement, p. 35.

¶¶ MS. of the late Mr. Spoure, with which I am favoured by Mr. Rodd of Trebartha, and Mr. Edward Hearle Rodd of Penzance. *Ante*, p. 43, *Note*‡.

*** Borlase, *Natural History*, p. 214.

††† Michell, *Manual of Mineralogy*, p. 2; *Ante*, p. 17; *Note*†.

‡‡‡ Taylor, (C. Dyke), *Proceedings of the Institution of Mechanical Engineers*, (Cornwall Meeting), p. 162.

to mine-gold, as the tin extracted from *stream*-ore is to that obtained from the *lodes*, of their respective countries.* Gold

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* At Ballinvalley in Wicklow gold and tin-ore were "dispersed through "a kind of stratum composed of clay, sand, gravel, and fragments of rock, "and covered by soil, which sometimes attained a depth of from twenty "to fifty feet....The native gold occurred in massy lumps, and in smaller "pieces, down to the minutest grain. One piece weighed twenty-one ounces, "another eighteen, a third nine, and a fourth seven." It is believed that from 1796 to 1862 more than one thousand eight hundred ounces were collected....The analysis of some small grains gave

Gold	92·320
Silver.....	6·170
Iron	0·780

"From a small quantity [certainly not more than 150 lbs.] of sand 3½ "lbs. [0·023 its weight] of stream-tin were obtained....some fragments "presenting the peculiar appearance to which the name of *wood-tin* has been "given." WEAVER, *Geol: Trans:* v, pp. 209-213. MALLET, *Journal of the Geological Society of Dublin*, iv, pp. 270-276. HENWOOD, *Cornwall Geol: Trans:* viii, pp. 627-634. (Abridged).

"Dans toutes les vallées des hautes chaines d'Eybenstock, on trouve une "grande quantité de galets, qui, amassés sur 3, 5 toises [19·18 to 31·97 feet] "et plus de hauteur, s'etendent à plusieurs milliers de toises de longueur. "En beaucoup de lieux, ils n'occupent pas seulement les bas-fonds; mais ils "reposent encore sur les pents des même chaînes....Ces galets sont formés "de roches granitiques et schisteuses, analogues à celles des monts environ- "nans; ils sont plus ou moins arrondis; ils ont un volume d'une ligne à "un pied, et quelquefois même trois pieds de diamètre; ils reposent ordin- "airement dans un sable à grains fins de quarz, et sont particulièrement "riches en étain. Les galets de granite tiennent le plus souvent ce métal "en filons; ceux de schorl-schiste, qui sont très abondans, en sont tous "imprégnés. On trouve, en outre, des galets de minerai d'étain massif, et "des cristaux désunis de 2 à 4 lignes [0·17 to 0·35 inch] de diamétre, épars "dans le sable. Quelques galets contiennent encore de oxidé, de la tourmaline, "et Charpentier dit qu' on y a trouvé de l'opale et quelques petites lamelles "d'or." MANES, *Annales des Mines*, ix, (1824), p. 653.

"Il y a en moyenne dans l'or du Rhin
93·400 d'or,
6·600 d'argent,
et, après l'analyse de M. Doebereiner 0·007 de platine."
DAUBREE, *Annales des Mines*, 4me Série, x, p. 22.

"On croit généralement dans l'Oural et á Saint Pètersbourg que l'or des "sables est ordinairement plus riche en or que celui des filons." *Annales des Mines*, 3me Série, v, p. 169.

"The detrital gold of Brazil—like the *stream*-tin-ore of Cornwall—is "always of better quality, and it invariably fetches a higher price, than the "mine-gold of the same neighbourhood."
HENWOOD, *Cornwall Geol*: *Trans*: viii, p. 359.

"In Bolivia I have found that the gold is purer in proportion as it is "further from its source." FORBES, (D.), *London, Edin: and Dublin Phil: Mag:* (4th Series) xxix, p. 133.

from one of the *stream*-works in the Saint Austell moors contained

Gold	90·12
Silver	9·05
Silica with sesqui-oxide of iron	0·83
	100· *

Notwithstanding the occurrence of gold in every part of Cornwall which has afforded *stream*-tin-ore, the quantities discovered have been so small that the entire produce of the county has, probably, amounted to no more than a few pounds weight;† and,

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In New Granada detrital-gold and mine-gold afforded respectively—
Detrital-gold..... 90·700 gold..... 9·300 silver;—
Mine „ ..... 83·100 „ ..... 16·900 „
BOUSSINGAULT, *Annales des Mines*, 3me Série, i, p. 446.

"The Mexican tin is extracted by means of washing, from the alluvious "lands of Guanaxuato, San Felipe, Robledal, and San Miguel el Grande, "as well as in the intendancy of Zacatecas.. .One of the [tin] ores most "common in Mexico is the *wood-tin* of English mineralogists." HUMBOLDT, *New Spain*, (Translated by John Black), iii, p. 296.

"In Australia tin-ore was first recognized, amongst the black sands "brought from the gold-fields, by Mr. George Foord, on the 11th March, "1853. Stream-tin is found in the Beechworth district, in the tributaries "of the Lenderderg, at Gympie, in the tributaries of the Yarra, in the bed "of the Thomson, and in many feeders of the Latrobe; [as well as] in "the Strathbogie ranges,...and at Taradale....The wash dirt varies in "thickness from a few inches to six feet. On the slate rock gold alone is "sought for, but on the granite bottom tin-ore is also found. Previously to "1868 the export of black sand and tin-ore had been 2,650·7 tons;—
„ tin ..... „ 5·5 „ .
SMYTH, (R. B.), *The Gold-fields and Mineral districts of Victoria*, pp. 42, 131, 412, 413.

"On the borders of the granite near Cape Raja, in the province of "Soengei-Liat...gold is found in the sand on the sea shore. The gold is "found there with tin-ore, and it occurs in the same way at the top of various "small valleys, in the provinces of Blinjoe and Djeboes." VAN DIEST, *Banca and its Tin Stream-works*, (Translated by Clement Le Neve Foster, B.A., D.S., F.G.S.), p. 64. Note

* Forbes, (D.), *London, Edin: and Dublin Phil: Mag*: xxxvii, (1869), p. 323.

† "Native gold...has in one instance been discovered in a *cross-course* "at *Huel Sparnon*, and also in the *gossan* of *Nangiles* in Kea." GARBY, *Cornwall Geol: Trans*: vii, p. 90.

"From a portion of a quartz-vein at Davidstowe I obtained, in 1852, a "trace of gold, and reported the fact to the Geological Society of Cornwall "...Recent experiments on the gossaniferous quartz from this locality, have "shown that it is not merely auriferous, but, in some small portions at least, "highly so." PATTISON, *Quarterly Journal of the Geological Society*, x, p. 248.

even of this, there is little doubt but that more has found its way to the crucible than to the cabinet.

(III). *Mechanical conditions of the tin-ground.* Every earlier writer* and all preceding details† show that the largest blocks in all these deposits bear marks of, greater or less, abrasion and attrition. In the immediate vicinity of their original localities, it is true, they are sometimes subangular or but slightly rounded,‡ but within distances comparatively short rude globular and spheroidal forms prevail. Of the more comminuted ingredients a principal portion is, perhaps at least, equally rounded; the rest comprehends angular fragments of various rocks and veins, perfect as well as fractured crystals of tin-ore; and with these any gold present is usually mixed. All interstices between the rougher components are filled with sand and clay.§

At *Levrean*‖ the *tin-ground* is divided horizontally, by—

(*a*). *False-shelf* which has extended through the entire tract wrought during five and forty years past, and yet exists in the present works. It consists of angular and subangular masses of granite, imbedded in disintegrated granitic matter; scarcely distinguishable from the *tin-ground* above and below; save that it contains but few masses of veinstone, and is destitute of ore.

Where the *tin-ground* is thus divided, by *false-shelf*, the lower is usually the richer portion.¶

(IV). *The bed which rests on the tin-ground* might scarcely have been distinguishable from the *detritus* beneath; but—that its ingredients are, perhaps, rather less abraded;—that, in one part or other of every detrital district, it contains masses of barren rock incomparably larger than any contained in other parts of the

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* *Ante*, pp. 3—4.

† *Ante*, pp. 4—44.

‡ *Ante*, pp. 9, 29, 43.

§ In one spot, at least, flints have been obtained from this part of the series. *Ante*, p. 27.

‖ Henwood, *Cornwall Geol*: *Trans*: iv, p. 62; *Ante*, p. 26.

¶ *False-Shelf* has been observed also at the *Merry-meeting*, and *Grove*, *stream-works* in Saint Austell, at Broad-water in Luxulion, at *Chyvenhall* in Paul, and, perhaps, also at *Carnon* in Feock. Henwood, *Cornwall Geol: Trans:* iv, pp. 59, 61, 62, 64. Carne, *Ibid*, p. 104.

series;*—and that it is almost, or altogether destitute of tin-ore.†

(V). *The bed succeeding that which rests on the tin-ground* presents a family likeness in neighbouring valleys; yet—even at a like depth its ingredients are not quite identical in all; indeed, different parts of the same vale—as, for example, at the sea-level and in the uplands present this (same) bed under very different aspects.

It would seem, therefore, that, after the *tin-ground* was deposited, timber sometimes flourished in the lower valleys,‡ whilst coppice and brushwood grew in and about the upland glens; and that some subsequent change in the relative levels of land and sea, affected the former,‡ without equally affecting the latter.§‖

It would also appear that the deposit of barren *débris* was—

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* Maton, *Observations on the Western Counties*, i, p. 153. Henwood, *Cornwall Geol*: *Trans*: iv, p. 61, Note; *Ante*, pp. 6, 7.

† At Pentuan an arrow head and a small chisel of some extremely hard alloy, were found lying directly on the *tin-ground*, at the bottom of an ancient shaft. Stocker, *Transactions of the Penzance Natural History Society*, ii, p. 89.

"In process of washing the diamond-yielding (*cascalho*) detritus in "Brazil, two lance-shaped arrow-heads,—one of petrosilex the other of rock-"crystal—were obtained by H. von Helmreichen." *Journal of the Royal Geographical Society*, xiv, p. 321.

‡ Colenso, *Cornwall Geol*: *Trans*: iv, p. 32. Rogers, (J. J.), *Ibid*, vii, p. 354.

§ Henwood, *Ibid*, iv, pp. 61—63; *Ante*, pp. 11, 12, 25, 31, *Table* II.

‖ "At Bovey Heathfield the lignite is overlaid by

Peat	0·5 foot thick;
Sand. Fine, white, quartzose	3·0 feet „ ;
Clay and sand. In separate masses, but not distinctly stratified	6· „ „
Clay. Very white	10· „ „ ;
Sandy clay. With angular and subangular stones	thickness unknown.

Nine feet below the surface of the plain we discovered a considerable number of dicotyledonous leaves in the white clay, and immediately below them lay some large roots." Pengelly, *Phil: Trans*: clii, (1862), p. 1031.

"Of the diluvial species of plants several leaves lie upon the soft white "clay, which cannot be distinguished from those of *Salix cinerea*, Linn.... "The most frequent leaf of the white clay is *Salix repens*. Linn? Entire "little leaves, beside fragments of the leaves of *Betula nana*, Linn. have "been found in the white clay. *Betula nana* is a boreal plant, which is at "home throughout the whole arctic zone; it is found also here and there "on the highland moors of Middle Europe....In the British islands it occurs "in Scotland only." Heer, *Ibid*, pp. 1080—1082.

once* or twice†—interrupted by a large formation of peat; but a settlement of the one and a growth of the other may have taken place at the same time or at short intervals; for—in one case at least‡—the peat is interlaid by finely-divided granitic matter as thin as tissue paper.

It may not be unworthy of remark that vegetable remains, of much the same kinds, occur within short (vertical) distances of the *tin-ground*, both north§ and south‖ of the water-shed.

(V). *The deep valleys which formerly opened to the sea, below high-water mark, on the south coast of Cornwall, contain alternations of mineral with vegetable matter, and of fresh-water with salt-water deposits.*¶ Of these several particulars *Table* III affords a brief comparison; from which it appears that at

CARNON.**

(1). A bed of sand and shells .. 2 feet thick;
(3). ,, ,, 3·5 ,,
} are interlaid by
(2). A bed of silt without shells 12· feet thick;

(1). A bed of silt and shells 0·8 foot thick;
(2). ,, ,, sand and shells 2· feet thick;
(4). ,, ,, sand and shells 3·5 feet thick;
(5). ,, ,, silt and shells 12· feet thick.
} are separated by
(3). Three separate beds of silt without shells 12· feet thick;

(1). A bed of silt without shells 6· feet thick;
(3). ,, ,, 31· ,, .
} are interlaid by
(2). Silt; with great quantities of shells..12· feet thick;

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* Henwood, *Cornwall Geol*: *Trans*: iv, p. 63. Barratt, (De la Beche's) *Report*, p. 403.

† Henwood, *Cornwall Geol*: *Trans:* iv, p. 61.

‡ Mr. Ralfs, *Ante*, p. 25, *Note*§.

§ Henwood, *Cornwall Geol: Trans:* iv, p. 59; *Ante*, p. 17.

‖ Henwood, *Cornwall Geol: Trans:* iv, p. 59; *Ante*, pp. 11, 31.

¶ Smith, *Geol*: *Trans*: iv, (O.S.) p. 406. Rashleigh, *Cornwall Geol. Trans:* ii, p. 282. Henwood, *Ibid*, iv, (1828), p. 58. Colenso, *Ibid*, (1829), pp. 32—37.

** Henwood, *Ibid*, iv, p. 58. Taylor, *Ante*, p. 30. Whitley, *Ante*, p. 30.

PENTUAN.*

(1).	A bed of sea-sand containing animal and vegetable remains..20· feet thick;	are separated by	(2). A bed of silt sometimes containing animal and vegetable remains ....2· feet thick;
(3).	„ „ ..0·4 foot „		
(1).	A bed of silt containing animal and vegetable remains .. 2· feet thick;	are separated by	(2). A bed of sea-sand containing shells .... 0·3 foot thick.
(3).	„ „ ..10· „ „ .		

SANDRYCOCK† near PORTH.

(1).	Peat.....4·1 feet thick;	are separated by	(2). Clay ..... 1·4 foot thick;
			(3). Clay, containing vegetable matter, with traces of the phosphate of iron 3·8 feet thick;
			(4). Sea-sand mixed with clay 3· feet thick;
			(5). Sea-sand fragments of shells and of clay-slate....4· feet thick;
			(6). Coarser sand, without shells 6· feet thick;
(7).	Peat..... 6· „ „ .		

The human remains were discovered‡ at—

Carnon.....58 feet.	below the surface.	below high-water	.....64 feet.		....46 feet below.
Pentuan..20-40 „ .			.... 14-34 „ .	..	4 „ above.
				..	14 „ below.

Neither speculation on the causes of these alternations, of fresh-water with marine substances, and of animal with inorganic matter; nor conjecture whether the human remains at Carnon and at Pentuan may—though they are imbedded at unequal depths and in different parts of the series—have belonged to the same, or to distant periods, can—especially in the absence of a perfect skull from Carnon§—properly find place in a mere descriptive memoir.

In the shallow *stream-works* of the moorlands the upper por-

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* Smith, *Geol: Trans:* iv, (O.S.) p. 406. Colenso, *Cornwall Geol: Trans:* iv, pp. 32–37.

† Rashleigh, *Cornwall Geol*: *Trans*: ii, p. 282.

‡ "Assuming these facts to be correct, we seem to have evidence that "Cornwall was inhabited by human beings when the earlier accumulations "of detrital matter were effected over the tin-ground."
DE LA BECHE, *Report*, p. 407.

§ *Table* III, *Note*†.

tions consist of much the same ingredients as both the adjoining and the neighbouring rocks and vein-stones.* They commonly occur in the state of sand and gravel;—differ little, if at all, from the beds of brooks in their vicinity;—and are disposed in, almost countless, thin layers, which alternate with yet thinner *partings* of hardened clay.

(VI). *Tin-ore* (Shodes†) *sprinkled on the surface at various altitudes.* The valleys and low-grounds—although, by far, the largest and richest—are not the only repositories of detrital tin-ore; for

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* Henwood, *Cornwall Geol: Trans*: iv, pp. 60—64. *Ante*, pp. 7, 8, 12, 25, 26, 27, 29, 30, 42, 43.

† "Litle stones, lye both in and nere the Brookes, and vpon the "mountaynes wher the metall lyeth; theis stones they call the Shoade, "being parcel of the veyne of owre, which being dismembred from the bodye "of the Loade, are meanes to direct to the place of profite, as the smoake "directeth where the fire lurketh." Norden, *Speculi Britanniæ*, p. 12.

"To find the *Loadworkes* the first labour is employed in seeking.... "certaine Tynne-stones, lying on the face of the ground, which are termed "*Shoade*, as shed from the main *Loade*, and made somewhat smooth and "round, by the waters washing and wearing....Having found any such, "they coniecture by the sight of the ground which way the floude came that "brought them thither, and so give a gesse at the place whence they were "broken off." Carew, *Survey of Cornwall*, (E. P.), f. 8.

"The shouders...pretend to such a nicety, as by the roughness or "smoothness of the shoad to tell you how far off the main load lies; nay, "to fit the very shoad, allowing for the wearing of it, to the place of the load "that it was broken off from by the flood." Carew, *Survey of Cornwall*, (Tonkin's Notes to Lord De Dunstanville's Edition), p. 29.

"Tin is [sometimes] found disseminated on the sides of hills, in single "stones, which we call Shodes, sometimes a furlong or more distant from "their lodes, and sometimes these loose stones are found together in great "numbers, making one continued course." Borlase, *Natural History*, p. 161.

"Shode [tin-ore] is disjunct and scattered, to some declined distance "from its parent lode, and is pebbly or smoothy angular." Pryce, *Mineralogia Cornubiensis*, p. 67.

"Shoad-stones are partially rounded and apparently water-worn; "they are found on, or at very small distances below, the surface; their "mineral characters are much the same as those of neighbouring lodes, of "which, indeed, it is supposed they were originally portions, removed by "diluvial action. As shode stones usually contain tin-ore they have been "carefully culled, and few now remain in the mining districts of Cornwall. "The Shoder commonly commenced his labours in low-grounds, where tin-"bearing diluvium abounded, and carefully sought tinny shode-stones as he "ascended the neighbouring hills; as he advanced he found them in greater "numbers, and at length he traced them to, what he believed to be, the "parent lode." Henwood, *Quarterly Mining Review*, i, (1830), p. 403.

—like lead-ore in the north of England,*—native copper on the shores of Lake Superior,†—and gold in the mountain-*cascalho*‡ of Brazil,—it has occurred—and, to some trifling extent, still occurs—in, more or less, abraded masses on the slopes of many hills; and this so frequently that, during early periods of Cornish mining industry, they were—and, indeed, to some extent, they still are—traced as guides to the *lodes* whence they had been riven. Such transported masses, however, are limited to slopes in no particular direction; but owing to the contour of the surface§ and the general directions of the *lodes*,‖ they have been more numerous on the northern¶ and southern than on the eastern and

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* "Shoad ore is a pretty sure indication of a vein where it is found, or "a little above, or higher on the acclivity of the surface; but you must judge "of the distance above, by the greater or less acclivity of the slope....The "shoad ore is found...in rough irregular globes...of all sizes, from very "large masses, down to the size of peas, and smaller grains,...and is fre- "quently coated with white on the outside....Float ore differs from the "shoad; the former being water-worn, the latter not. The float ore is "generally mixed with water-worn bullets and gravel; the shoad never, "unless it has been washed off the superficies of the vein by some stream "of water." Forster, *Section of the Strata between Newcastle and Cross Fell*, pp. 276—278.

† "Ten leagues south of Lake Superior there is a single lump of native "copper about four tons weight...but no vein of copper has been discovered" "[in the neighbourhood.] Pryce, *Mineralogia Cornubiensis*, p. 61.

"It is well known that transported masses of native copper are occa- "sionally met with in the diluvial deposits which are abundantly spread "over the country...south of Lake Superior." Houghton, *Silliman's Journal*, xli, p. 29.

"Fragments of metallic ores and native copper,—the latter sometimes "weighing several hundred pounds...occur occasionally...in a layer of clay "resting either on coarse drift or...on the rock." Foster and Whitney, *Report on the Geology of Lake Superior*, pp. 186—191. (Abridged).

"About [1864] two years since [a mass of copper] which weighed about "eighteen tons was found loose on the drift covering the rock...near Portage "Lake." Bauerman, *Quarterly Journal of the Geological Society*, xxii, p. 452.

‡ "There is a difference between the *cascalho* in the mountains and "that in the rivers; the embedded stones in the mountain-*cascalho* are "rough and angular, but in that of the rivers they are rounded."

Manoel Ferreira da Camara, (Southey's), *History of Brazil*, iii. p. 827.

§ De la Beche, *Report*, pp. 19—20; *Fig.* 1. *Ante*, pp. 45—47.

‖ Henwood, *Cornwall Geol*: *Trans*: v, pp. 250—254, *Pl.* xi, *Fig.* 5, *Table* ciii; *Ibid*, viii, p. 674, Note†; *Journal of the Royal Institution of Cornwall*, iv, (No. xiii), p. xvi; *Annales des Mines*, 7me Serie, ii, p. 172.

¶ An instructive example of *shode-tin-ore* has been lately discovered by the Reverend William Borlase, M.A., Vicar of Zennor, in the ravine which bounds his glebe, and within gun-shot of the Bristol Channel.

western declivities; but whether alike plentiful on opposite sides of the water-shed* seems unknown.

It has been shown† that a slightly elevated body of slate extends from the northern slope of Hensbarrow and Killivreth Down,—surrounds the granite of Castle an Dinas and of Belovely Beacon,—and merges in the schistose strata which border the Bristol Channel. North-east of this elevation both the rocks and the—more or less—rounded detritus in the moors of Saint Austell and Lanlivery are almost exclusively granitic‡ south-west of the dividing range, however, the *shelf*, the *tin-ground*, and the *overburden* are for—by far—the most part of slate *and elvan*, mixed, at intervals, with small proportions of granite,§ all bearing traces of abrasion. But whilst the band of schistose rocks maintains a higher level than the dissimilar—though it may be contemporaneous—beds of *detritus* on either side, it is much lower than the peaks, ridges and slopes of Hensbarrow, Killivreth Down, Helmen-Tor, Belovely Beacon, and Castle an Dinas; from the rocks,‖ *lodes*, and thin strings of vein-stone, from some of, if not from all, which—small as their produce has been of late years —both the *tin-ground* and the overlying *débris* are assumed to have been derived,¶ whilst this boundary of slate, between the different kinds of transported matter, is, itself, free from all trace of detritus. Moreover the rather considerable tract of cultivated land which surrounds the village of Tregoss and the hamlet of Pendean,—though bounded on three of its sides by the refuse of ancient *stream-works***—bears no specimen of *drift*, or evidence of diluvial action.††

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* *Ante*, pp. 45—47.

† *Ante*, pp. 24, 30.

‡ *Ante*, pp. 25—28.

§ *Ante*, pp. 28—30.

‖ Boase, *Cornwall Geol*: *Trans*: iv, p. 252. Henwood, *Ibid*, v, p. 120, Note. *Ante*, p. 24.

¶ "Those who have studied the decomposed granite near Saint Austell, "traversed as it is by a multitude of branches and strings of oxide of tin, "would have little difficulty in perceiving that if a body of water were made "to rush over it, the decomposed granite would be readily removed, and that "the broken-up strings and branches of tin-ore would be rolled into pebbles, "and distributed just as the stream-tin now occurs down the valleys in the "neighbourhood." De la Beche, *Report*, p. 398.

** *Ordnance Geological Map*, Sheet xxx.

†† Boase, *Cornwall Geol*: *Trans*: iv, p. 248. *Ante*, p. 30, Note†.

If—whilst *stream-tin* was deposited in the valleys, and *shodes* were scattered on more elevated parts of the surface—tin-ore was also swept into the sea,* it must now be—as on shore—concealed by more recent deposits;† for, during the recent Hydrographical Survey, soundings—almost without number—failed to detect anything of the kind,‡ in even of a single instance.

The granite of Cligger-head§ is traversed by narrow veins of quartz; and both the rock and the veins contain tin-ore. The action of the sea saps the base of the cliff; and large portions of it fall almost every winter. These are rapidly disintegrated by the waves; and the ore they had contained is gleaned by a few poor people, who earn a scanty livelihood by preparing it for market. On several other parts of the coast small quantities of tin-ore are collected;‖ but most of it, if not the whole is sepa-

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* "Granite and tin-stone shingle occur round the Land's-end and "Scilly Islands." AUSTEN, *Quarterly Journal of the Geological Society*, vi, p. 76.

† "If the mines [of Scilly] had ever been very productive of tin, "some traces of diluvial tin-ore would, even in modern days, be from time "to time found in the low-grounds, but in neither of them has any tin-ore "been discovered within the recollection of the oldest inhabitant, nor is "there a record of such a fact at any former period; neither has any tin-ore "ever been found pulverized amongst the sands of the sea shore, as it fre-"quently is in the mining parts of Cornwall which border on the sea." CARNE, *Cornwall Geol*: *Trans*: vii, p. 153.

‡ Captain (now Rear Admiral) George Williams, R.N. Officer in charge of the Hydrographical Survey, MS.

§ Sedgwick, *Transactions of the Cambridge Philosophical Society*, i, pp. 131—132. Boase, *Cornwall Geol*: *Trans*: iv, p. 303. Henwood, *Ibid*, v, p. 94. Von Oeynhausen and Von Dechen, *Phil*: *Mag*: *and Annals*, v, p. 169. Thomas, (R.), *Mining Review*, ii, p. 265. De la Beche, *Report*, p. 162.

‖ Borlase, *Natural History*, p. 164. *Ante*, p. 9, Note.†

"Small quantities of tin-ore are frequently thrown up by the sea, on "the beach below the Little Bounds engine [in Saint Just.] One or more "workmen may generally be seen, on the return of the tide after high-water, "searching for tin-ore amongst the sand and shingle. It is probable that "this comes from the back of some of the tin-lodes which run under the "sea." CARNE, *Cornwall Geol*: *Trans*: ii, p. 342.

"Tin-ore was found in small quantities, many years ago, a little below "high-water-mark, on the margin of the Loe-pool at the bar, close below the "furnace discovered in 1860." ROGERS, *Report of the Royal Institution of Cornwall*, xl, (1863, p. 80).

"From a stratum, also between high and low water, on the sea-shore at "Gunwalloe fishing cove, tin-ore is now about to be returned, under a licence "from the Duchy of Cornwall. This, however is visible only on occasions "of unusual stripping of the shingle, from the rocks at the base of the cliff; "and occurs (as I am told by the holder of the licence) in little dishes or "hollows in the face of the rock." MR. ROGERS, of Penrose, MS.

Hunt, *Mineral Statistics*, 1870, p. 8.

rated by the action of running water,* or of the sea, from the waste which escapes in neighbouring mines.

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* "Tin is also found among the slime and sands of rivers and of the "seashore (as in some creeks of Falmouth harbour several lords of the soil "have lately experienced to their advantage) washed down probably from the "hills, and resting in such sheltered situations that the sea has not power "to carry it off." Borlase, *Natural History*, p. 164.

"Besides stream-works, we have another sort...occasioned by the refuse "and leavings from the stamping-mills, &c., which are carried by the rivers "down to the lower grounds...I have been told that about seventy years "back, [1708] the low lands and sands under Perran Arworthall, which are "covered almost every tide with the sea, have, on its going off, employed "some hundreds of poor men, women, and children, incapable of earning "their bread by any other means." Pryce, *Mineralogia Cornubiensis*, p. 135.

"The sand on Marazion *green* [affords]...sufficient tin-ore to pay in some "measure for its *streaming*, which process, on a small scale, is here in "operation." Boase, *Cornwall Geol*: *Trans*: iii, p. 178.

"At Polladan-cove [in Saint Just] portions of the sea-sand are often "collected and *dressed* for sake of the tin-ore deposited amongst it by the "rivulet flowing through the *dressing-floors* in Nancherrow-vale. Wherever "there is a strip of beach at the base of the cliff persons are employed to "collect any stones containing tin-ore; whether these may be separated "from the rubbish of the mines by the action of the waves, or torn from "the *backs of lodes* beneath the sea, is difficult, if not impossible, to deter-"mine." Henwood, *Ibid*, v, p. 8.

Hunt, *Mineral Statistics*, 1870, p. 8.

"Tin-ore is now being got—under licence from the Duchy—from the "sand brought down and deposited by the river Cober, at the head of the "Loe-pool during winter, when the water rises some feet above the ordinary "surface." Mr. Rogers, MS.

"Small streams which rise amongst the hills south of Camborne, Tuck-"ingmill, and Pool, are—in various parts of their course to the sea near "Gwithian—used for *(dressing)* washing the produce of *Condurrow*, *Dolcoath*, "*Cook's-kitchen*, *North Roskear*, *Wheal Crofty*, *Tin-Croft*, and some other "mines; but from each mine they carry off, in suspension, small quantities "of tin-ore still adhering to its matrix. The separation which *stamping* "and other processes had failed to accomplish at first, is, however, gradually "effected by the action of running water; portions of ore are therefore "collected from lower parts of the stream, by appliances exactly similar to "those which had been inefficient to arrest them above." Thomas, *(Captain Charles)*, *Cornwall Geol*: *Trans*: viii, p. 354, Note‡.

It has been stated that of late thirty thousand Pounds worth of tin-ore has been collected annually from these streams.

"The ore which escaped from *Gongo Soco* [in Brazil] was treated a "second time at Taboleiro, about a mile from the mine, and yielded, on an "average about a (Troy) pound of gold per month." Henwood, *Ibid*, viii, p. 354.

The entire County now yields only about fifty tons of *Stream*-tin-ore a year.*

The Royalties *(Dues)* reserved by the owners of mineral rights, are, generally, higher in *stream-works* than in mines. In one instance—where the difficulty and risk are exceptionally great—the proprietors receive one-twentieth; in most other cases, however, they are content with from one-fifteenth to one-twelfth, but in one district—perhaps the roughest and poorest in Cornwall—the Lord exacts one-tenth of the entire produce.†

Ancient furnaces—locally known as *Jews'-houses*—have, from time to time, been discovered in various parts of Cornwall; and rudely moulded blocks of metal—generally called *Jews'-house-tin* have been found still more frequently. Such furnaces and masses of metal have—it is scarcely requisite to say—no necessary relation to detrital deposits; but the smelting-works and their products are often—perhaps mostly—found in the neighbourhood of the *stream*-works; and imperfectly smelted specimens of *Jews'-house-tin*,—sometimes obtained—consist of *stream*-ore mixed with charcoal and cemented by metallic-tin.‡ Neither furnaces nor blocks of *Jews'-house-tin*, however, have been numerous on the coast or at great elevations.

"At *Morro Velho* [in the same district] the ore which escaped "from the *dressing-floors* in suspension, was collected on the margin of a "neighbouring stream; where—by being again stamped and washed,—it "yielded from 1856 to 1863, one thousand three hundred and sixty five "(Troy) lbs. of gold." SYMONS, *Reports of the Saint John d'el Rey Company*, "xxvii, p. 40; xxviii, p. 47; xxix, p. 43; xxx, p. 43; xxxi, p. 48; xxxii, p. 60. DIETZSCH, *Ibid*, xxxiii, p. 50; xxxiv, p. 49.

* Mr. Francis Michell of Calenick and Mr. Richard Wellington of Chyandour, MSS.

† "When a Streaming Tinner...takes a lease...he agrees to pay, the "owner or lord of the fee, a certain part clear of all expense...The consider-"ation is generally one sixth, seventh, eighth, or ninth,...or instead thereof, "he contracts to employ so many men and boys...and to pay the land-owner, "for liberty, from twenty to thirty shillings a year for each man, and...for "every boy...half as much as for a man." PRYCE, *Mineralogia Cornubiensis*, p. 132.

‡ *Ante*, p. 38. Note.

Traces of ancient smelting-works *(Jews'-houses)* have been discovered in the various spots,—and described by the several authorities,—undermentioned :—

LOCALITIES.	AUTHORITIES.
WESTERN DISTRICT.	
Madron	Le Grice, *Cornwall Geol: Trans:* vi, p. 44.
Marazion-green	Edmonds, *The Land's-end District*,* p. 9.
WESTERN-CENTRAL DISTRICT.	
Mawnan	Mr. Joshua Fox, MS.†
Gwennap	Francis (W.), *Gwennap, a Descriptive Poem*, p. 100, Note.‡
CENTRAL DISTRICT.	
Mawgan	Michell (J.), *Manual of Mineralogy*, p. 75.§
Withiel	*Gentleman's Magazine*, xcvi, p 125.‖
Lanlivery	Hare, *Mining Journal*, September, 1855.¶
EASTERN DISTRICT.	
North Hill	Rodd, (F.), *Report of the Royal Institution of Cornwall*, xxxii, p. 58.**

Block-moulds of stone have been met with, in, at least two instances ;—

LOCALITIES.	AUTHORITIES.
WESTERN-CENTRAL DISTRICT.	
Gwennap	Francis, (W.), *Gwennap, a Descriptive Poem*, p. 100, Note ††.
EASTERN DISTRICT.	
North Hill	Rodd, (F.), *Report of the Royal Institution of Cornwall*, xxxii, p. 58.‡‡

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* Near the river immediately west of Marazion, and at from three to six yards beneath the sandy surface, ancient walls of unhewn stone, rudely made pottery, charcoal, ashes, and slag mixed with grains of metallic tin, and,—within a short distance,—fragments of bronze, were discovered. EDMONDS, *Transactions of the Penzance Natural History Society*, i, p. 348. *The Land's-end District*, p. 9.

† *Ante*, p. 13, Note §.

‡ *Ante*, p. 18, Note.

§ *Ante*, p. 38, Note.

‖ *Ante*, p. 39, Note.

¶ "From a *Jews'-house* discovered at Lanlivery by a *tinner* called John "Hare specimens of the ore, and the tin in a regular and refined state were "secured, but no blocks were found." HENWOOD, (GEO.), *Lectures on Geology and Mining*, ii, p. 11, Note.

** *Ante*, p. 44, Note †.

†† *Ante*, p. 18, Note.

‡‡ *Ante*, p. 44, Note†.

Jews'-house-tin has been found in many parts of the western and central districts; but under various conditions, and in masses of unequal weight;

LOCALITIES.	WEIGHTS.	AUTHORITIES.
WESTERN DISTRICT.		
Saint Just	5·00lbs. Avoir.	Carne, *Cornwall Geol*: *Trans*: ii, p. 293.*
,, ...	6·00 ,,	Le Grice, *Cornwall Geol: Trans*: vi, p. 44.†
Madron (Bossuliack) ..	— ,,	
,, Trereife.....	26·00 ,, ‡	
,, Tremethick ..	38·00 ,,	Whitley (H. M.), *Journal of the Royal Inst*: *of Cornwall*, No. xiii, p. xxxviii.§
WESTERN-CENTRAL DISTRICT.		
Gwinear	37·00 ,,	Carne, *Cornwall Geol*: *Trans*: ii, p. 293. Le Grice, *Ibid*, vi, p. 44.‖
Constantine	3·90 ,,	Mr. Hunt, F.R.S., Keeper of Mining Records in the Royal School of Mines MS.¶
Manaccan.....	0·47 ,,	Professor Tennant, F.G.S.; and Mr. Thomas Davies, F.G.S.; MS.**
,, moor	a fragment.	Mr. Rogers, of Penrose, MS.††
Saint Martin Meneage..	1·25 ,,	Dr. Jago, F.R.S., President of the Royal Institution of Cornwall MS.‡‡

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* *Ante*, p. 5, Note ‡. There may be some uncertainty whether this is not the first specimen referred to by Mr. Le Grice. *Cornwall Geol: Trans:* vi, p. 44.

† *Ante*, p. 5.

‡ This specimen was presented by Mr. Le Grice to the PENZANCE NATURAL HISTORY SOCIETY, *Cornwall Geol: Trans*: vi, p. 45. *Ante*, p. 5.

§ *Ante*, p. 5.

‖ *Ante* p. 11, Note +.

"The largest [mass] I have heard of weighed 34lbs., it was found in a "hedge in the parish of Gwinear, and having been offered for sale at the "Angarrack Smelting House, the Goth of a refiner put it at once into a ladle "and melted it down." LE GRICE, *Cornwall Geol: Trans*: vi, p. 44.

¶ This specimen is preserved in the Museum of Practical Geology, Jermyn Street, London.

** This specimen is in the British Museum.

†† "A small fragment of very imperfectly smelted tin,—supposed to be "*Jews'-tin*—was discovered on Manaccan-moor by Mr. R. J. Cunnack who "presented it to me. It was found in connection with fragments of what "had every appearance of slag." MR. ROGERS, MS.

‡‡ This specimen is preserved in the Museum of the Royal Institution of Cornwall. *Ante*, p. 15, Note.

WESTERN-CENTRAL DISTRICT, *Continued.*

LOCALITIES.	WEIGHTS.	AUTHORITIES.
Mawnan	3·--4lbs. Avoir.	Mr. Joshua Fox, MS.*
Near Truro	0·32 ,,	Professor Tennant, F.G.S.; and Mr. Thomas Davies, F.G.S., MS.+
Saint Agnes.....	7·70 ,,	Mr. Hunt, F.R.S., Keeper of Mining Records in the Royal School of Mines.‡
CENTRAL DISTRICT.		
Creed.....	11·50 ,,	Borlase, *Journal of the Royal Institution of Cornwall.* Supplement, i, p. 26.§
Saint Mewan	75·00 ,,	Mr. Francis Michell, MS.‖
Saint Austell	6·00 ,,	Borlase, *Journal of the Royal Institution of Cornwall,* Supplement, p. 25.¶
,, ...	80· ,,	Mr. William Petherick, of Saint Austell, MS.**
Lanlivery	46·25 ,,	Mr. Hunt, F.R.S., Keeper of Mining Records in the Royal School of Mines, MS.++
Roche .....about	20·00 ,,	Hitchins and Drew, *History of Cornwall,* ii, p. 587.‡‡
Mawgan	39·5 ,,	Michell (J.), *Manual of Mineralogy,* p. 75. Poole, *Journal of the Royal Institution of Cornwall,* i, (No. iv), p. 9.§§

The cabinets at Menabilly contain other specimens of *Jew's-house-tin.*

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* *Ante*, p. 13, Note§.

+ This specimen is deposited in the British Museum.

‡ ,, ,, ,, Museum of Practical Geology in Jermyn Street, London.

§ *Ante*, p. 38, Note.

"This specimen is deposited in the Museum of the Royal Society, London." BORLASE, *Journal of the Royal Institution of Cornwall*, i, Supplement, p. 26.

"For the satisfaction of the curious [a] specimen is deposited in the "Desk of Cornish Fossils at the Museum in Oxford." BORLASE, *Journal of the Royal Institution of Cornwall*, i, Supplement, p. 26. *Ibid*, p. 26.

A quantity of *Jews'-house* tin, cut into pieces of about an inch square, was lately offered for sale at one of the eastern smelting-houses.

‖ This slab remains at Calenick smelting-house, near Truro. p. 38, Note.

¶ *Ante*, p. 37, Note ¶¶. *Ante*, p. 38, Note.

** This remarkable mass is now in the collection of Mr. J. C. Daubuz of Killiow, *Ante*, p. 38, Note.

++ This specimen is preserved in the Museum of Practical Geology, Jermyn Street, London.

‡‡ *Ante*, 39.

§§ *Ante*, p. 38, Note *.

The foregoing columns show that masses of *Jews'-house*-tin have, of late years, been discovered not only in every part of Cornwall west of the Fowey and the Camel* which has afforded *stream-tin* ore, but that they have been obtained also in Meneage, a part of the County in which no tin-ore, of any kind, has ever been found. A few of them have been procured from primitive smelting-sites, and one was met with on the coast; but no single example has ever yet been brought to light in the neighbourhood of an ancient highway. The shapes of these blocks are often so irregular as to defy mere verbal description; but, perhaps, most of them show some approach to an oval on the upper side, thinning, however, from about the middle to the circumference on the lower; resembling, in fact, the rude *pigs* run from the small furnaces of native iron-smelters in the Himalaya,† or the lumps of iron cast—in hastily scraped pits—when the quantities of molten metal exceed the requirements of the founders. These *Jews'-house* blocks vary, from a few ounces to eighty pounds *(Avoir.)*, in weight. The specimens hitherto described,‡ have generally been invested with lead-coloured crusts of the oxide of tin; in some of which traces of chlorine§ have been detected.

I have now to offer my grateful acknowledgements to the Noblemen, and Gentlemen, who have afforded me opportunity for these enquiries, and my warmest thanks to the Superintendents of works, and working-men, whose advice, and assistance have enabled me to finish these—my last—labours in the

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* Whether the eastern moorlands were formerly sprinkled, in like manner, with masses of *Jews'-house*-tin we have now no means of ascertaining; for it appears (MACLEAN, *Ante*, p. 190) that some centuries ago they had been in great measure exhausted.

† Traill, *Asiatic Researches*, xv, p. 138. Herbert, *Ibid*, i, p. 252. Henwood, *Extracts from the Records of Government* (Calcutta, 1855), p. 31.

‡ Borlase, *Journal of the Royal Institution of Cornwall*, i, Supplement, pp. 25, 26. Gregor, *Cornwall Geol: Trans*: i, p. 52. Michell, (J.), *Manual of Mineralogy*, p. 74. Collins, *Journal of the Royal Institution of Cornwall*, iii, (No. xiii), p. 83. Napier, *Ibid*, p. 84, Note. Percy, (Dr.), F.R.S. MS.

§ During high winds and heavy rains the windows in West Cornwall are often slightly obscured by thin incrustations of common salt.

field;* to some I am more deeply indebted than to others but I fear to particularize, lest—by unintentional omissions—I may pain some to whom I am under the deepest obligations.

W. J. HENWOOD.

3, CLARENCE PLACE, PENZANCE,
1871—1873.

CORRECTION.

Page 199, line 8...*for* Marazion-march *read* Marazion-marsh.

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* Henwood, *Cornwall Geol*: *Trans*: v, pp. 3, 386; viii, p. 722.

NETHERTON, PRINTER, TRURO.

TABLE I.

COMPOSITION OF THE TIN-GROUND, AND OF THE ROCKS ADJOINING AND IN THE VICINITY.

Locality.	Mineral Character		
	Of the *tin-ground.*	Of the *(Shelf)* rock beneath the *tin-ground.*	Of the strata adjoining the *Shelf* on either side.
Bosworlas*	Disintegrated granite, granitic vein-stones, tin-stone, and crystals of tin-ore either broken or entire.	Granite of unequal hardness.	Hornblendic slate, 1·6 mile N.W.
Bejowans†	Granitic matter, quartz, schorl-rock, various vein-stones of the granitic series, and small quantities of tin-ore, mostly *wood-tin.*	Granite, disintegrated.	Hornblendic slate, 1·4 mile N. The *Garth* mine yields wood-tin, 2·5 miles N.E.‡
Cold-harbour§	Granitic matter, clay, and rounded masses of vein-stones from the granitic series.	Granite of unequal hardness.	Hornblendic slate 1·4 mile N. ,, ,, 2·0 miles E. ,, ,, 2·8 ,, W.
Tregilsoe‖	Slate, quartzose slate, *elvan*, and vein-stones of the slate series impregnated with tin-ore, rounded and fractured granules of cassiterite.	Clay-slate, exceedingly soft.	*Elvans* within 0·5 mile N. & S. Granite.... 1·5 miles N.W. ,, 3·2 ,, S.E.
Carn-wartha	Masses of granite, schorl-rocks, and vein-stones of the granitic series, mixed with granitic, schorlaceous, and quartzose sand and gravel, interspersed with rounded masses and angular fragments of tin-ore in the state of sand and gravel.	Granite disintegrated. Granite, traversed by veins of schorl and tin-ore.	Slate..... 3·2 miles N.W. ,, ... 2·7 ,, S.
Lezerea¶			
Carnon**	Masses of granite, slate, *elvan*, and various vein-stones of both the granite and slate series, mixed with tin-ore either in large rounded bodies or in the state of gravel and sand.	Clay-slate, traversed by *elvans.*	Granite..... 2·8 miles W. ,, ... 3·2 ,, S.W. ,, ... 3·8 ,, N.W.
[illegible]	[illegible]	[illegible]	[illegible]

TABLE II.

COMPARISON OF VEGETABLE REMAINS IN THE UPPER AND THE LOWER PARTS OF THE SAME, AND OF DIFFERENT VALLEYS.

LOCALITIES.	VEGETABLE REMAINS, IN	
	Upper parts of the valley.	Lower parts of the valley.
	GROUNDS DECLINING TOWARDS THE SOUTH.	
Cold-harbour to Marazion-marsh	Peat*	Peat, enclosing nuts, leaves, and the branches, trunks, and roots of hazel, willow, and oak.‡
Tregilsoe ,, ,, ...	Peat†	
Wendron-moors to the Loe-pool	Peat, enclosing nuts and branches of hazel.§	Peat, enclosing nuts and the leaves, branches and trunks of hazel, oak, and other trees,‖ (*about a foot above low-water mark*).
Higher Carnon to Restronguet Creek	Silt, mixed with moss, leaves, nuts, the branches and trunks of hazel, alder, and oak, oyster—and other—shells, the remains of beetles, the horns and bones of deer, and human skulls.¶	Silt (hardened mud).** (*Some six feet above low-water*).
Tregoss moors	Peat, sometimes—but not very often—imbedding leaves, branches and slender trunks of alder and oak.††	
Pentuan ..... *Wheal Virgin, (upper works)*....	.....	Rough shingle, gravel, sand, and silt; interspersed with trunks, branches, and leaves of trees, nuts, moss, rushes, and the wings of beetles.‡‡
,, ... *Happy Union, (lower works)*....	.....	Separate layers of rounded rocks, shingle, gravel, and silt; containing in the deeper part, roots and trunks of oaks which had